

Installation and  
Operation Instructions for  
**LAARS PLATE™**



Semi-Instantaneous, Plate and Frame Water Heater

**FOR YOUR SAFETY:** This product must be installed and serviced by a professional service technician, qualified in hot water boiler and heater installation and maintenance. Improper installation and/or operation could create carbon monoxide gas in flue gases which could cause serious injury, property damage, or death. Improper installation and/or operation will void the warranty.

**⚠ WARNING**

Installer must comply with startup and installation instructions to avoid a dangerous situation.

**⚠ AVERTISSEMENT**

D'installation doit se conformer aux instructions d'installation et de démarrage pour éviter une situation dangereuse.

**TABLE OF CONTENTS**

**TABLE OF CONTENTS:**

<b>SECTION 1: GENERAL INFORMATION .....</b>	<b>4</b>
1.1 INTRODUCTION .....	4
1.2 DESCRIPTION .....	4
1.3 FEATURES 5	
1.4 APPLICATIONS.....	5
1.5 ENERGY SOURCES.....	5
1.6 DESIGN CONDITIONS & CONSTRUCTION.....	6
1.7 SAFETY .....	7
1.7.1 Operating Precautions.....	7
1.7.2 Storage and Transportation.....	7
1.7.3 Safety Features .....	7
1.7.4 Safety Notation.....	8
1.7.5 Proper Training .....	8
1.7.6 Safety Precautions .....	8
<b>SECTION 2: INSTALLATION INSTRUCTIONS .....</b>	<b>10</b>
2.1 RECEIVING, HANDLING, AND STORAGE.....	10
2.1.1 Examining the Unit .....	10
2.1.2 Compliance with Codes .....	11
2.2 SITE PREPARATION .....	11
2.3 INSTALLATION CLEARANCES AND UNIT DIMENSIONS.....	12
2.4 UNIT PLACEMENT .....	14
2.5 PIPING INSTALLATION AND UNIT CONNECTIONS .....	15
2.6 ELECTRICAL CONNECTIONS.....	16
2.7 WATER QUALITY .....	17
<b>SECTION 3: OPERATION AND CONTROLS.....</b>	<b>18</b>
3.1 INTRODUCTION .....	18
3.2 LP SERIES FUNCTIONAL DESCRIPTION .....	18
3.2.1 Plate and Frame Heat Exchanger Construction.....	19
3.3 CONSTRUCTION AND PERFORMANCE .....	21
3.4 SAFETY CONTROLS.....	22
3.5 3-WAY CONTROL VALVE .....	23
3.5.1 Performance Data (3-Way Control Valve) .....	23
3.5.2 Calibration Instructions (3-Way Control Valve).....	24
3.5.3 Auto and Manual Control (3-Way Control Valve).....	25
3.5.4 3-Way Controller Status LED Indication .....	26
3.6 PREPARATION OF UNIT FOR OPERATION.....	26
3.7 UNIT STARTUP PROCEDURES .....	26
3.8 UNIT SHUTDOWN PROCEDURES.....	28
3.9 CONTROLLER INTRODUCTION .....	29
3.9.1 PID Controller Overview .....	30
3.10 CONTROLS STARTUP .....	32
3.11 DATA COMMUNICATIONS .....	33
3.11.1 Temperature Controller Terminals Layout .....	33
3.11.2 LAARS controller communication features .....	34
3.11.3 LAARS Default Settings Summary for communication .....	34

**TABLE OF CONTENTS**

3.11.4 Modbus RTU Communication Wiring .....	35
3.11.5 Modbus/BACnet Data Addresses and Points .....	36
3.11.6 Instructions to Change Communication Settings Manually .....	37
3.12 DRY CONTACTS .....	44
3.12.1 Contact closure input (enable/disable) .....	44
3.12.2 Fault Relay Contacts .....	44
<b>SECTION 4: MAINTENANCE .....</b>	<b>45</b>
4.1 CIRCULATING PUMP MAINTENANCE.....	46
4.2 POWER CONNECTION REWIRING .....	47
4.3 PLATE HEAT EXCHANGER MAINTENANCE.....	48
4.3.1 General Heat Exchanger Maintenance Procedures.....	48
4.3.2 Clean-In-Place (CIP) Cleaning (Plate and Frame and Brazed Plate) .....	48
4.3.3 Heat Exchanger Reassembly.....	55
4.4 T&P OR PRESSURE ONLY RELIEF VALVE REPLACEMENT .....	56
4.5 STRAINERS INSPECTION AND REPLACEMENT .....	57
4.6 3-WAY CONTROL VALVE MAINTENANCE.....	58
4.6.1 3-Way Control Valve Maintenance.....	58
4.6.2 3-Way Control Valve Replacement.....	58
4.7 TEMPERATURE CONTROLLER.....	60
4.8 REPLACEABLE PARTS LIST .....	60
4.9 RECOMMENDED SPARE PARTS: .....	61
4.10 INSPECTION SCHEDULE .....	62
4.11 PARTS AND ACCESSORIES.....	63
4.12 CONTROL BOX PARTS.....	67
<b>SECTION 5: TROUBLESHOOTING .....</b>	<b>70</b>
<b>SECTION 6: TECHNICAL DRAWINGS &amp; FORMS .....</b>	<b>75</b>
6.1 DIMENSIONAL DRAWINGS .....	75
6.2 CLEARANCE DRAWINGS.....	76
6.3 PIPING AND INSTALLATION DRAWINGS .....	77
6.4 ELECTRICAL WIRING DIAGRAMS/SCHEMATICS .....	80
6.5 FORMS AND RECORDS .....	82
6.5.1 Water Heater Controller Programming Record Sheet.....	82

**SECTION 1: GENERAL INFORMATION**

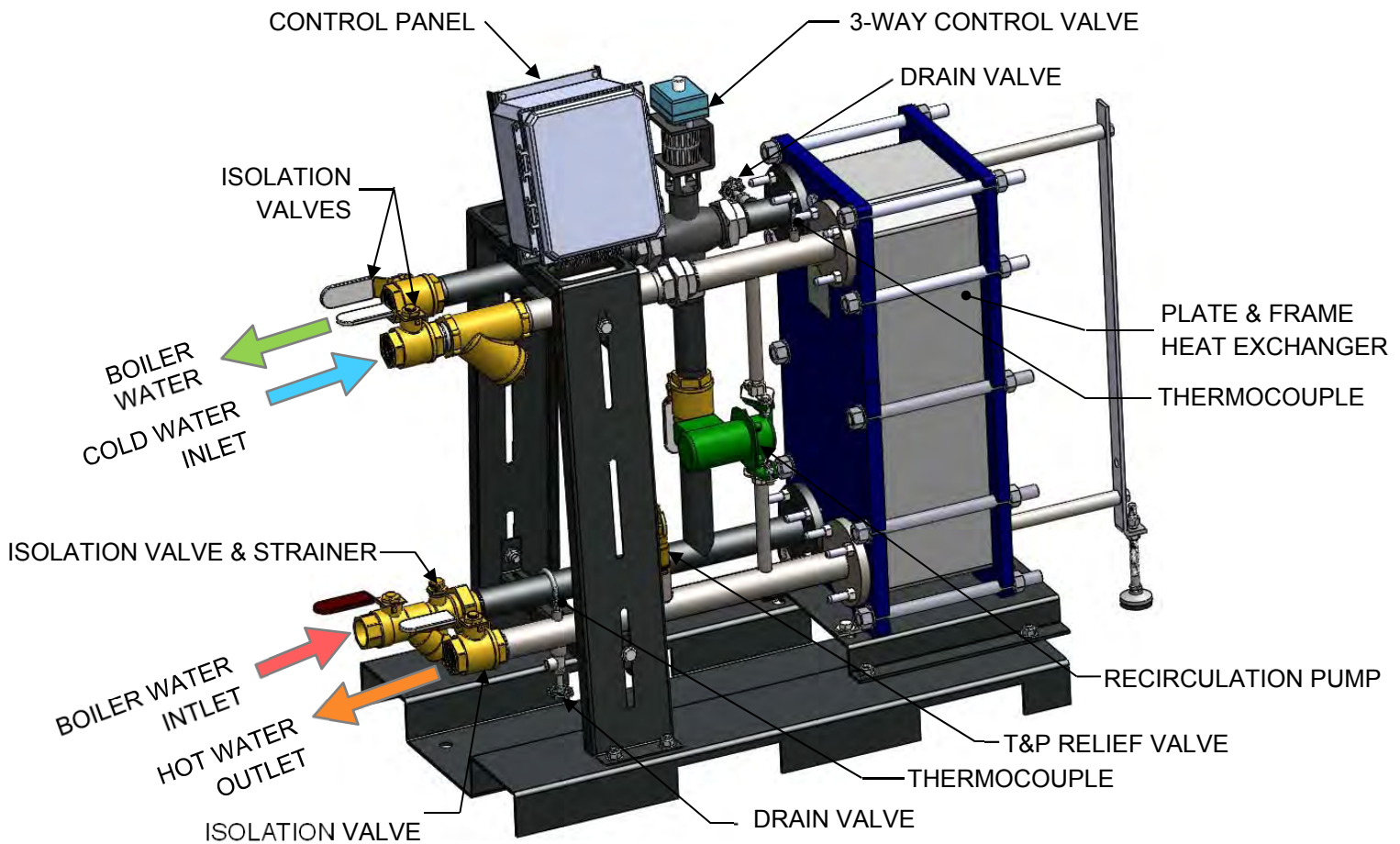
**SECTION 1: GENERAL INFORMATION**

**1.1 INTRODUCTION**

The purpose of this manual is to provide an installation, operation, and maintenance procedural guide for the LP Series water heaters for boiler water or HTHW to domestic water applications.

**1.2 DESCRIPTION**

The LP Series water heaters are the engineered solutions for facility owners/managers who need water-to-water heat transfer solution in a small space. They are constructed of stainless steel domestic water piping and carbon steel boiler water piping to ensure long, leak-free operation. Each water heater is equipped with a control panel, 3-way control valve, and fittings etc., which makes it ideal for new and retrofit installations.



**FIGURE 1.2: LP Series Component and Function Diagram**

The units are engineered for water heating systems feature a compact plate heat exchanger, they require less floor space, making them perfect for mechanical rooms where space is limited.

**SECTION 1: GENERAL INFORMATION****1.3 FEATURES**

- Compact design to fit in small mechanical rooms and standard doorways
- Complete packaged system with components engineered to specific application requirements
- Energy efficient
- High recovery
- Stainless steel plates
- Double Wall Plate and Frame heat exchanger
- ASME compliance heat exchanger

**1.4 APPLICATIONS**

LP Series units are used in wide range of domestic water heating applications including either new construction or replacement of existing units. Most common application examples include:

- Apartment complexes
- Prisons/correctional facilities
- Hospitals/medical centers/nursing homes
- Hotels/casinos/entertainment
- Schools/colleges/universities/dormitories
- Government buildings
- Commercial office buildings
- Factories/industrial facilities
- Fitness centers/health clubs etc.

**NOTE:**

Contact your Local LAARS sales representative to determine if any applications-related information is required.

**1.5 ENERGY SOURCES**

LP Series Hot Water Heaters are engineered and manufactured to use one of the following energy sources to produce domestic hot water:

- Boiler Water
- High Temperature Hot Water (HTHW)

## SECTION 1: GENERAL INFORMATION

**1.6 DESIGN CONDITIONS & CONSTRUCTION**

The LP Series units are designed and manufactured from superior materials of highest quality. Each unit meets or exceeds requirements of ASME Section VIII, Div.1 Code.

**Heat exchangers:** Heat exchangers are gasket plate and frame construction and the plates are stainless steel.

**Controls and trim:** LP Series units are equipped with electronically activated fully modulating 3-way control valves and feedforward controls which offer tight temperature control performance in water heating applications. Their advanced control panel LCD user interface display, allow easy adjustment of set points and safety alarms and setup of communication with Building Management System.

Standard package also includes ASME Temperature and Pressure Relief valve in domestic water piping and recirculating water line with circulator.

Fabricated skid package includes single point inlet and outlet piping connections to produce domestic hot water using heating hot water. Stainless steel construction domestic water piping manifolds and carbon steel boiler water piping manifolds including fittings and accessories.

**SECTION 1: GENERAL INFORMATION****1.7 SAFETY****1.7.1 Operating Precautions**

In order to achieve maximum performance from the unit, the precautions and procedures described below must be strictly followed:

- The unit should be installed, operated, and serviced only in accordance with the information in this manual.
- The unit should be installed according to designs prepared by qualified facility engineers, including those of a structural, mechanical, electrical, or other applicable disciplines.
- The unit should not be operated or serviced until a safety training program has been established by the customer.
- The unit should be operated and serviced only by qualified technical personnel in accordance with all applicable codes, laws, and regulations.
- The unit must be used according to the specification given
- Pressure and temperatures should not exceed limits indicated on the name plate attached to the unit.
- For initial startup refer to all instructions in **Section 3.7: Unit Startup Procedures**.
- The heating and heated fluids should be free from any debris.
- The unit should operate only with fluid that it was designed for.
- The system should be designed to prevent the unit from encountering pressure shocks.
- All strainers installed on the unit should be periodically cleaned as per the maintenance schedule. (See Recommended Inspections Time Interval).
- Refer to **Section 2.6: Electrical Connections** for proper grounding of the unit.

**1.7.2 Storage and Transportation**

The units should be stored in a clean place away from a corrosive environment or weather elements (e.g. rain, snow), preferably indoors and maintained between 32°F and 110°F ambient operating temperature. During transportation, ensure that they are not exposed to mechanical damage. Units should not be exposed to cold or hot temperatures beyond those specified by LAARS.

**1.7.3 Safety Features**

The customer is responsible for maintenance of the safety features of the LP Series water heater such as guards, safety labels, safety controls, interlocks and lockout devices.



**SECTION 1: GENERAL INFORMATION****1.7.4 Safety Notation**

In this manual there will be four levels of important note types in regards to those accompanying the text of this document. Note headers will appear as shown and described below:

**NOTE:**

Important information, but not associated with safety practices.

**CAUTION!**

Indicates potential safety concerns, possible material damage, and unsafe practices that may lead to damage of property, injury or death.

**WARNING!**

Indicates a potential health hazard that *MAY* lead to injury or death.

**DANGER!**

Indicates an immediate health hazard that *WILL* lead to injury or death.

**1.7.5 Proper Training**

Proper training is the best protection against accidents. Operating and service personnel must be thoroughly familiar with the basic construction and operation of the LP Series semi-instantaneous water heater and all applicable safety precautions. If any of the provisions of this manual are not fully and completely understood, contact LAARS technical service for advice and information. Please have the serial number of the unit available. The serial number is located on the name plate attached to the front of the unit below the control panel.

**1.7.6 Safety Precautions****DANGER!**

- ***WATER TEMPERATURES OVER 125°F CAN CAUSE SEVERE BURNS INSTANTLY, OR DEATH FROM SCALDS.***



- **Children, disabled persons, and the elderly are at the highest risk of being scalded.**
- **See instruction manual before setting temperature at water heater.**
- **Feel water before bathing or showering.**
- **Contact LAARS technical support at 800-900-9276 for more information.**



**SECTION 1: GENERAL INFORMATION****WARNING!**

- Fluids under pressure may cause injury to personnel or damage to equipment when released. Be sure to shut off all incoming and outgoing water shutoff valves. Carefully decrease all trapped pressures to zero before performing maintenance.
- Before attempting to perform any maintenance on the unit, shut off all electrical power to the unit from an exterior switch.
- Electrical voltages up to 120 VAC may be used in this equipment; therefore, the front panel door on the unit's power box must be closed at all times, except during maintenance and servicing.
- A three-pole switch must be installed on the electrical supply line of the unit. The switch must be installed in an easily accessible position to quickly and safely disconnect electrical service. Do not affix switch to any part of the water heater itself.

**CAUTION!**

DO NOT use this water heater if any part has been under water. Call a qualified technician to inspect and replace any part that has been under water.

**SECTION 2: INSTALLATION INSTRUCTIONS****SECTION 2: INSTALLATION INSTRUCTIONS****WARNING!**

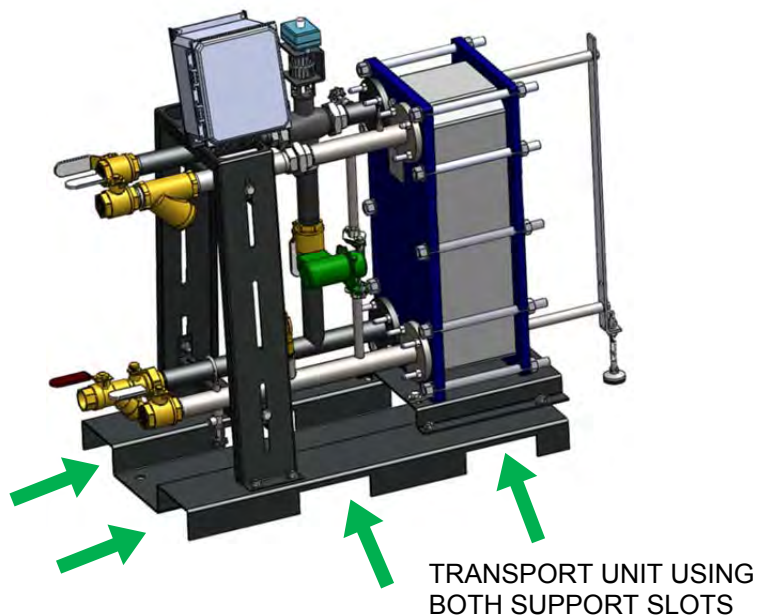
- **INSTALLER MUST COMPLY WITH STARTUP AND INSTALLATION INSTRUCTIONS TO AVOID A DANGEROUS SITUATION.**
- Startup and installation forms **MUST** be submitted to a local representative or risk loss of coverage under warranty.
- The inspection log must be maintained and up-to-date and kept in close proximity to the LP Series unit for inspection.

**NOTE:**

The startup must be performed by a factory authorized representative.

**2.1 RECEIVING, HANDLING, AND STORAGE**

LP Series water heater base frame is designed in such a way that they can be carried from all four directions using forklifts or pallet jacks provided. The unit must be properly supported over the forks, as indicated by the arrows in Figure 2-1.



**FIGURE 2-1: Support Slots for Transport**

**2.1.1 Examining the Unit**

LP Series water heaters are thoroughly inspected and tested prior to shipment. Upon receipt of the LP Series water heater, please carefully inspect the entire unit and its components for any damages during shipping. If any evidence of damage is detected that could affect the safe operation of the unit, contact Factory or the authorized sales representative to report the damage and to receive instructions on how to proceed.

**SECTION 2: INSTALLATION INSTRUCTIONS**

After the inspection has been completed, we advise that all pressure and control components be checked to assure that they meet design specifications, the name plate and the specification tags. In case of any discrepancy, contact Factory or an authorized sales representative, before proceeding with the installation.

**2.1.2 Compliance with Codes**

The LP Series water heater is constructed and stamped in accordance with ASME Boiler and Pressure Vessel Code, Section VIII – Division 1. Other codes or approvals which apply will be labeled on the LP Series water heater.

The LP Series water heater installation must be performed only by technically qualified persons. The installation must conform to all national, state, or provincial and local code requirements established by the authorities having jurisdiction as well as specific instructions in this manual. Authorities having jurisdiction should be consulted before installations are made.

**2.2 SITE PREPARATION**

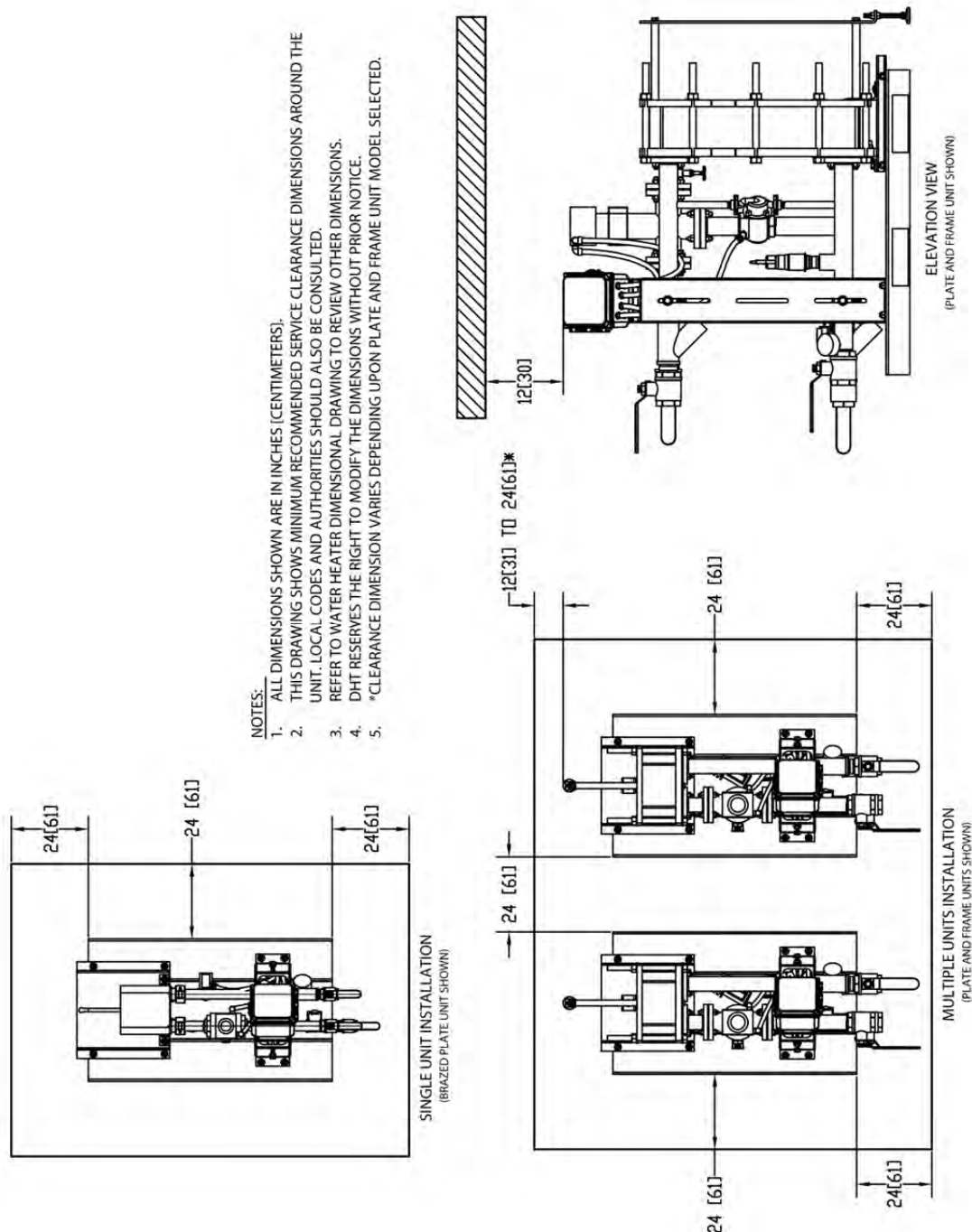
- A firm and level foundation is required (a six- to eight-inch thick concrete pad is preferable).
- Secure the LP Series water heater to the building floor or mounting pad. For attachment to the foundation, use the four holes in the base.
- Proper rigging techniques should be followed while moving unit around.
- The LP Series water heater must be plumb and level to function properly.
- The LP Series water heater should be placed with at least 12" headroom clearance.

## SECTION 2: INSTALLATION INSTRUCTIONS

### 2.3 INSTALLATION CLEARANCES AND UNIT DIMENSIONS

The LP Series minimum acceptable clearances are shown in Figure 2-1 and dimensions are shown in Figure 2-2a and 2-2b. The minimum clearance dimensions are indicated in the drawings. However, if local building codes require additional clearances, the local building codes shall supersede these requirements.

All water piping and electrical conduit or cable must be arranged so that they do not interfere with the removal of any panels, or inhibit service or maintenance of the unit.



**FIGURE 2-1: LP Series Installation Clearance Drawing**

SECTION 2: INSTALLATION INSTRUCTIONS

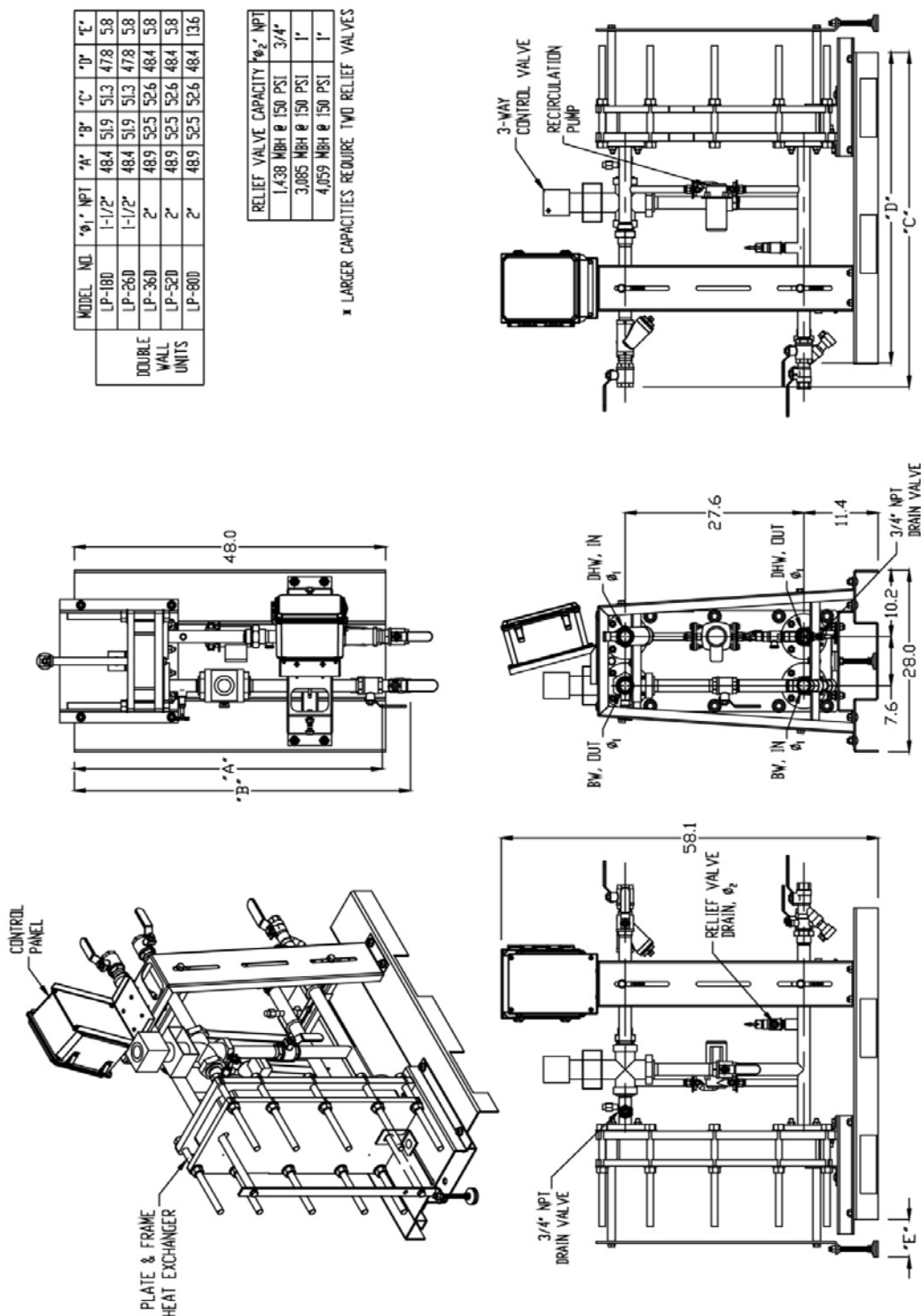


FIGURE 2-2a: LP Series Plate and Frame Dimensional Drawing

**SECTION 2: INSTALLATION INSTRUCTIONS****2.4 UNIT PLACEMENT**

The unit should be mounted to the suitable floor, concrete pads, or structural construction, following factory guidelines and applicable architectural and local code requirements to assure the safe operation of the unit.

**NOTES:**

1. Proper rigging techniques should be followed while moving heavy equipment.
2. Maintain proper levels in order for the unit to function properly and follow clearance, dimensional, and applicable piping drawings.

**CAUTION!**

Refer to **Section 2.5 Piping Installation and Unit Connections** for piping and installation instructions. LP Series units must be installed to permit relief valve drain per local codes.

## SECTION 2: INSTALLATION INSTRUCTIONS

## 2.5 PIPING INSTALLATION AND UNIT CONNECTIONS

LP Series units can be installed in various domestic water applications within the rated temperature and pressure conditions. Refer to Section 6.3 for appropriate Piping and Installation Drawings per your application requirements before making piping connections. CAD drawings are also available on the LAARS website for layout specification. If any special application help is needed, please call your local representative or factory for specific application information.

## NOTE:

Also consult local codes and authorities in addition to typical Piping and Installation Drawings.

- **Domestic water piping:** The exact location of domestic water inlet and outlet ports of the unit, as well as pipe diameters and thread/flange size, can be determined for the drawing supplied with the unit. Properly sized water lines should be connected to the unit. All piping and fittings should be clean and free of debris. It is important that the piping systems are balanced when two or more units are in parallel in order to achieve the combined capacity and proper temperature control. Refer to typical Piping and Installation Drawings in Section 6.3. The most up-to-date drawings are available at [www.dhtnet.com](http://www.dhtnet.com).

## NOTE:

Building recirculation piping shall be properly sized to provide sufficient capacity to dissipate residual heat within the tube bundle of the water heaters during the periods of low demand.

- **Boiler water piping:** Boiler water inlet and return piping to be sized per given flow rates to the control valve.

## CAUTION!

High temperature water can present a very dangerous situation because of the high pressures and temperatures. Follow all mandatory and recommended procedures and safety rules to avoid any hazardous situation.

All valves on the source line should be closed during the installation process. Connect the energy source to the piping leading to the control valve. Determine the exact location of the inlet connections and piping size using the drawing of the unit. Refer to typical Piping and Installation Drawings in Section 6.3.

- **Drain discharge piping:** All LP Series units are equipped with pressure and temperature relief valves and drain connections on both boiler and domestic water side connections. They should be piped directly to a safe drain according to appropriate plumbing codes as explained in Piping and Installation Drawings in Section 6.3.

## WARNING!

Make sure that the pressure and temperature relief valve is piped to a proper drain per instructions and codes. Scalding injury and/or water damage can occur from either the manual lifting of the lever or the normal operation of the valve if it is not piped to a proper drain. Ensure that the piping is of the proper material and rating for the temperature and pressure of the system and that it is secured to prevent possible injury. If the valve fails to flow water or reseal, consult the factory.



**SECTION 2: INSTALLATION INSTRUCTIONS****2.6 ELECTRICAL CONNECTIONS**

All field wiring connections for power and controls are inside the control panel at the front of the LP Series water heater. The wiring label is attached to the inside aluminum door of the control box. An external electrical disconnect (not supplied with the water heater) with adequate overload protection is required. The water heater must be grounded in accordance with national, state or provincial, and local codes.

Connect the system to the correct voltage. The LP Series water heater requires 120V AC, 15Amp service with ground (H, N, G) supplied from a suitable circuit breaker or fused disconnect. The circulation pump has a 120V constant speed fractional HP motor that operates continuously when the power to the unit is on.

Refer to **Section 6.4** for standard electrical wiring drawings/schematics/terminal block connections.

**CAUTION!**

All electrical wiring must be in accordance with all local, state, and national codes that apply. Do not exceed the rated current of the D.C. power supply (100MA) or the form 'C' relay outputs (5A/240VAC resistive).

**WARNING!**

Hazardous voltages are present within the enclosure. Installation or service should be carried out only by trained personnel.

**CAUTION!**

Do not operate the pump without water in the unit! Do not turn on power before filling with water! Failure to do so can cause damage to the pump.

**SECTION 2: INSTALLATION INSTRUCTIONS****2.7 WATER QUALITY**

- Before piping the unit into the system, the system must be thoroughly flushed to remove sediment, flux, filings, and other foreign matter. The heat exchanger can be damaged by build-up of corrosion due to sediment.
- The manufacturer cannot be held responsible for any damage caused by incorrect use of additives in the system.
- Mineral buildup in the heat exchanger reduces heat transfer, overheats the heat exchanger, and causes failure. Leaks in the heater or piping must be repaired at once. Leakage of boiler water or HTHW into domestic water side is unsafe and needs to be repaired immediately.
- Air elimination is extremely important from the domestic hot water system. Ensure proper air vents are installed in the piping systems that are prone to trap air pockets.
- Consider using water hammer arrestors or an expansion tank to dampen the spikes in water pressure since water hammering can lead to premature failure of the unit.
- Water hardness contributes to the formation of scaling, which impacts the performance of the heater exchanger and may lead to premature heat exchanger failures. Water softening may be required if it is high.
- Do NOT use softening agents that use salt, as they can cause corrosion of the heat exchanger and piping components, instead of telling them not to use artificially softened water.
- Elevated chloride levels in water accelerate corrosion of the heat exchanger and piping system materials.
- The pH must always be within the acceptable limits (6.5 to 8.5) of the heat exchanger.

**NOTES:**

- Consult LAARS factory before using LP Series units for any other non-standard applications.

**SECTION 3: OPERATION AND CONTROLS****SECTION 3: OPERATION AND CONTROLS****3.1 INTRODUCTION**

This chapter provides information and instructions for following topics:

- LP Series functional description
- Preparation of unit for operation
- Unit startup procedure instructions
- Unit shutdown procedure instructions
- Controller overview & startup settings

**3.2 LP SERIES FUNCTIONAL DESCRIPTION**

LP Series units are engineered using boiler water or HTHW as the heating medium. Heat exchanger is plate and frame construction with double wall configuration. LP Series incorporates the proven LAARS PID controller coupled with the high efficiency plate and frame heat exchanger. This water heater is designed to satisfy potable water heating needs in commercial and institutional environments. The packaged system utilizes simple, easy-to-understand, real-time load tracking and responsive controls to maintain accurate hot water temperatures under various load patterns. The LP Series can be coupled with both condensing and non-condensing type boilers with wide range of operating temperature ranges to achieve high efficiency within an optimized space. The control system features temperature sensors installed on domestic inlet and outlet piping, transmitting a millivolt signal through quality twisted shielded wiring. The signal transmits directly into the PID controller which, in turn sends a 4-20 MA signal to the electrically activated three-way control valve to achieve accurate temperature control over various demand situations.

The LP Series can efficiently produce higher flow domestic hot water, depending upon the temperature rise and available boiler water temperature and flow rate. Skid mounted with a state-of-the-art PID control panel, plate and frame heat exchanger, electric three-way control valve and non-ferrous circulator pump.

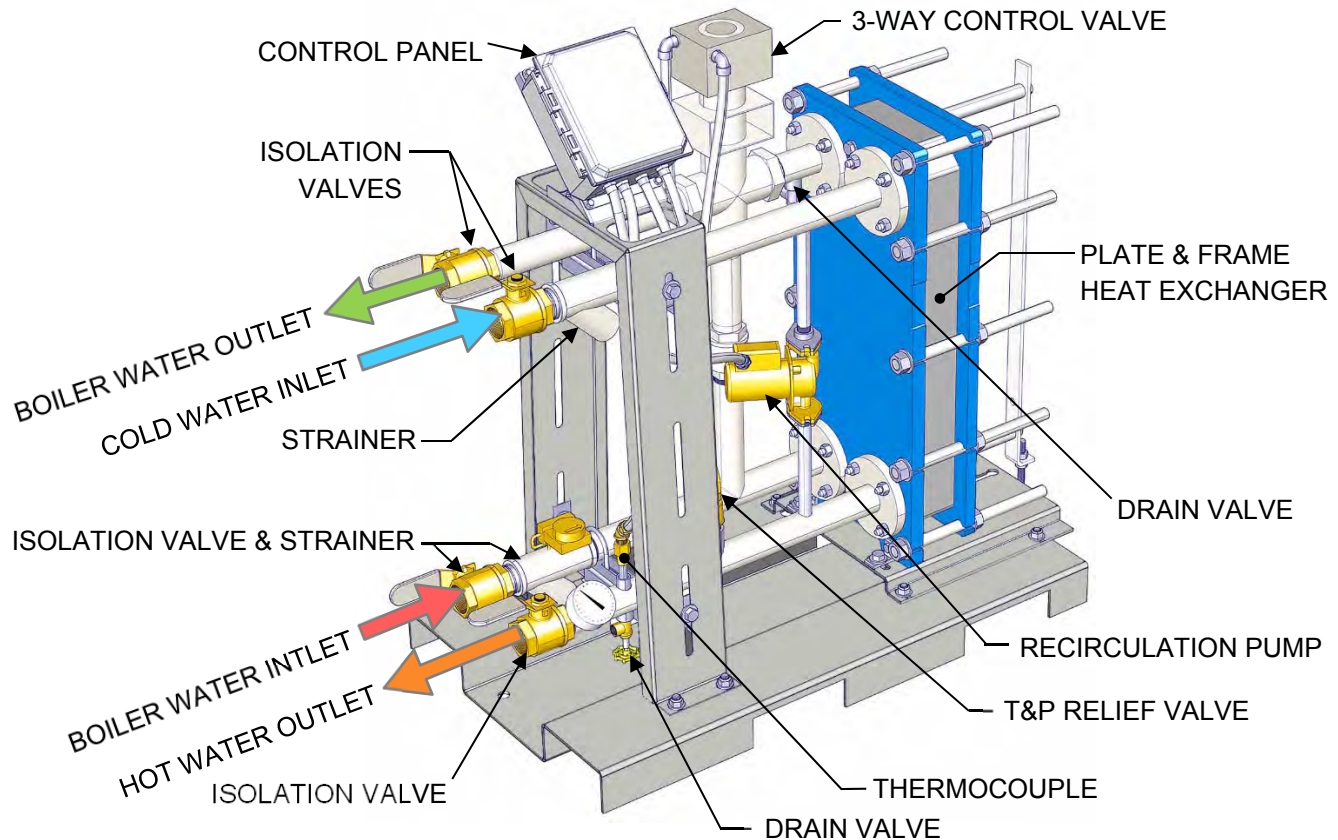
Easy removal of heat exchanger via flanged connections allows the complete removal of the heat exchanger without disturbing the water heater piping. Isolation valves, inlet strainers and backflush connections provided for scheduled maintenance.

Cold domestic water enters the heat exchanger through the cold water inlet connection (as shown in Figures 3-1a. It is distributed over the plates in the heat exchanger and flows downwards. Heated domestic water then exits the heat exchanger from the hot water outlet connection on bottom of the unit. Unit also includes a constant speed recirculation pump which continuously circulates the heated domestic water through the heat exchanger to ensure there is always hot water present in case of demand. Domestic hot water supply temperature is maintained by either electronic operated 3-way control valve.

Boiler water or HTHW enters the heat exchanger through the inlet connection located on the bottom and flows upwards to have counter flow arrangement for effective heat transfer. Control valve which is modulated by the 4-20 mA output from the controller, depending upon the reading from the temperature sensor on the domestic hot water outlet of the heat exchanger. Unit employs closed loop feedback control system to maintain target temperature set point in tight range. Boiler or HTHW exits through the outlet connection on the top of the heat exchanger as shown. Flow rate of heating medium is modulated to maintain the desired set point in varying load conditions.

The control panel can be rotated 180 degrees to orient the control surface in the desired direction.

**SECTION 3: OPERATION AND CONTROLS**



**FIGURE 3-1a:**

### 3.2.1 Plate and Frame Heat Exchanger Construction

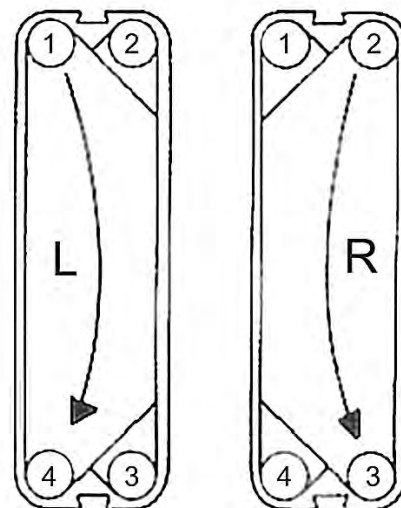
**Frame:** The heat exchanger consists of a frame plate (Head), a pressure plate (Follower), a carrying bar, a lower bar, and a column. Tightening bolts are used to press the plates together. This is depending on the type of heat exchanger and can be different in some applications.

**Plates:** The plate package consists of plates with a groove along the rim of the plate and around the ports. The number of plates is, as well as size and dimension, dependent on the thermal output required.

The LAARS plates are designed in such a way that they both can be used as right and left plates. The plates just have to be turned 180°.

Right and left plates:

- On a right plate the flow runs from hole #2 to hole #3 or reverse from hole #3 to hole #2.
- On a left plate the flow runs from hole #1 to hole #4 or reverse from hole #4 to hole #1.
- The opening of the corner holes are described in a "plate code index." For instance, 1234 means that all corner holes are open.



## SECTION 3: OPERATION AND CONTROLS

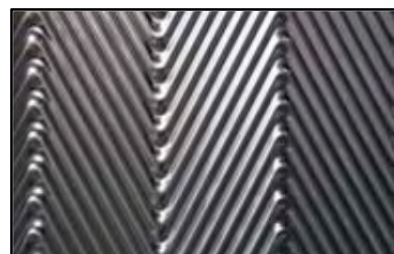
Every plate can be identified by the packing configuration, the plate code index, and thermal short or thermal long execution.



START PLATE WITH GASKET    LEFT HAND FLOW PLATE WITH GASKET    RIGHT HAND FLOW OR END PLATE WITH GASKET



THERMAL LONG PLATE



THERMAL SHORT PLATE

**Gaskets:** The groove provided in the plates holds the special gasket. The purpose of this gasket is to prevent intermixing of the media and leakage to the outside. The gaskets are selected to suit the actual combination of temperature, chemical environment, and possible other conditions to be considered. They can be supplied in Viton, Nitrile, or EPDM.

The following types of packings are being used in our plate type heat exchangers:

- Clip-on gaskets
- Glue gaskets
- "Sonder Lock" gaskets (new generation Clip-on gasket)

**Clip-on gaskets:** These gaskets (Sonder Snap) and "Sonder Lock" (new generation glue-free gasket) require no adhesive. They are located by pushing the gasket fully down into the gasket groove. The gaskets are held in place by the interference fit – narrowed portions of the gasket groove are pressed to ensure a secure fit. Make sure groove and gasket are clean!



CLIP-ON GASKET DETAIL



SONDER LOCK GASKET DETAIL



**SECTION 3: OPERATION AND CONTROLS**

**Glue type gaskets:** The surfaces of these gaskets need to be clean and free of oil. Use only chloride free glues, such as Pliobond 20 or 30, Bostic 1782, 3M EC 1099, and Bond Spray 77. Follow the manufacturer's instructions printed on the cover of the glue.

**CAUTION!**

When using commercial solvents and adhesives, follow the manufacturer's recommendations carefully, as many of these materials are hazardous.

**O-rings:** Make sure that the flat side of the O-ring fits into the special packing groove of the plate. If the O-ring is not provided with a flat side, the thinnest side of the O-ring needs to be fitted into the groove. It might be necessary to use a little glue for positioning the O-ring during assembly of the heat exchanger.

**Rubber liners:** On some model types, the rubber frame plate nozzle liners have an O-ring molded into the liner itself. This molded O-ring fits into the gasket groove in the first plate. Therefore, if new gaskets have been fitted, the O-ring portion of the gasket around the nozzle hole will have to be cut off prior to assembly back into the frame.

### 3.3 Construction and Performance

LP Series units are Double-wall construction heat exchangers which features boiler and domestic water separated by an air gap between two walls, rather than being separated by only a single wall. This greatly enhances protection against leakage of the boiler water into the domestic water. If there is leakage in a wall, the water is collected within the air gap which is vented to atmosphere for leak detection. Similarly, if the domestic water leaks through a wall, it is collected within the air gap and is vented to atmosphere for leak detection.

The advantages of double-wall construction include:

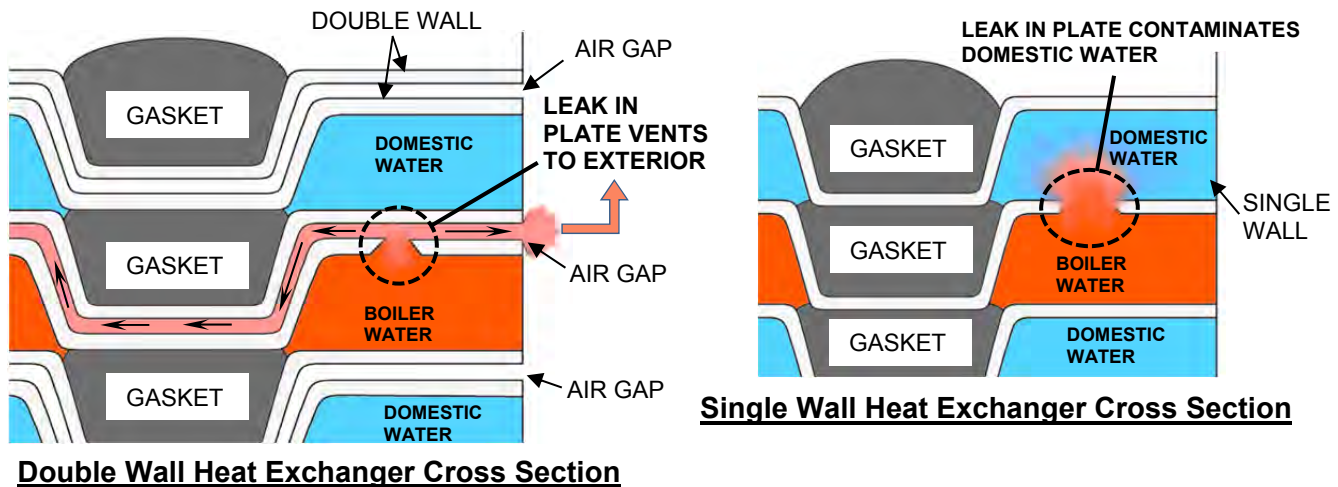
- Prevention of cross-contamination
- Easy inspections and low maintenance
- Fully visible and vented leak detection between plates
- Potable water and heating medium are completely separated.

Leakage can be caused by corrosion, erosion, and vibration, and can result in the domestic water system being contaminated by a heating medium, such as hydronic water, glycol solution, etc.

There is no practical way to have the heating medium sterile or free from harmful treatment compounds or corrosion by-products. A low pressure/temperature heating medium circuit does not ensure contamination protection of indirect, single-wall water heaters. Whether they are shell and tube, shell and coil, plate and frame, or any other type, all consist of relatively thin wall heat transfer surfaces separating the heating medium from the domestic water system. Therefore, the potential for cross contamination is real and in some instances contamination has occurred.

Several states and cities are now insisting on double-wall vented construction in all indirect type domestic water heaters. Plumbing codes have also been re-written to include double-wall protection. See Figure 3-2 for an illustration of how a single wall and double wall differ in construction, and how both function in the event of a hole, allowing fluid to leak through a plate.

**SECTION 3: OPERATION AND CONTROLS**



**FIGURE 3-2: Double-Wall and Single-Wall Heat Exchanger Leakage Comparison**

NOTE: Optional heat exchanger insulation is available.

### 3.4 Safety Controls

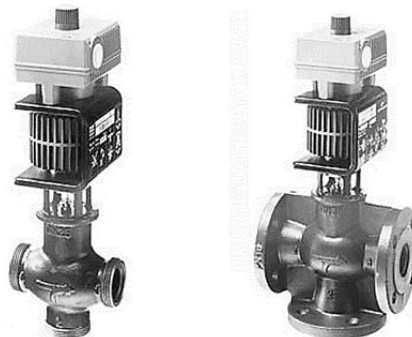
Automatic over-temperature limit function is included, which will cut off electricity supply to the fail-close control valve during over temperature condition. Power supply is restored to the control valve when the unit goes back to normal operating temperature conditions.

The unit includes alarm functionality in the safety controls. A red light turns on when the hot water temperature reaches the alarm setting, and then alarm starts sounding. In the next step, the power supply to the control valve is interrupted, causing it to close. Hot water outlet piping includes pressure and temperature relief valve to release high temperature hot water to safe drain in order to protect the unit. When the unit goes back to normal operating temperature conditions, a green light turns on, but the siren continues until the owner manually presses the alarm silence button to turn it off. Power to the control valve is restored, and the unit goes back into normal operation.



**SECTION 3: OPERATION AND CONTROLS****3.5 3-Way Control Valve**

Two types of 3-Way Control Valves are available, one with NPT connections of up to two inches (2") in size, and one with larger sized flanged connections. Both are shown in Figure 3-3.



**FIGURE 3-3: 3-Way Control Valves with NPT (left) and Flange Connections (right)**

**3.5.1 Performance Data (3-Way Control Valve)**

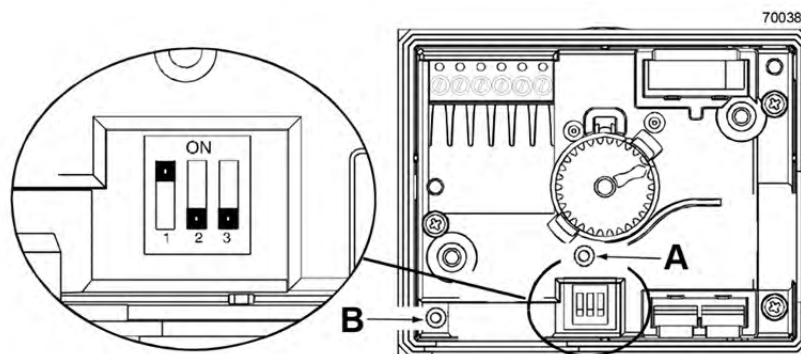
- LP Series water heaters include MXG-461 3-Way Control Valve actuators.
- Control valve modulates the flow of boiler/HTHW through the heat exchanger based upon the signal from the controller to maintain DHW supply temperature to target setpoint.
- Valve is fast positioning: < 2 seconds
- High rangeability: (1000:1)
- Low leakage rates: Leakage at  $\Delta P_v = 14.5 \text{ psi (0.1 Mpa) (1bar)}$ .
  - A  $\rightarrow$  AB Max. 0.02 % Cv (to IEC534-4)-
  - B  $\rightarrow$  AB Depends on operating conditions (<0.2% Cv)-
- Temperature of medium = 34°F to 266°F (1°C to 130°C)
- UL listed
- Before shipment, every unit is inspected to make sure the valve is opening and closing with respect to signal from the controller.
- 3-Way Control Valve is factory set to "Automatic" mode of operation.
- 3-Way Control Valve is powered by 24VAC electricity.
- 3-Way Control Valve is actuated by 4 to 20 mA signal from the controller.
  - 4mA means valve is in fully bypass position (flow direction from port B to AB). Flow path from A to AB is closed when valve is de-energized (fail safe feature).
  - 20mA means valve is in full open position (flow direction from port A to AB)

**SECTION 3: OPERATION AND CONTROLS**

**3.5.2 Calibration Instructions (3-Way Control Valve)**

3-WAY CONTROL VALVE DIPSWITCH FUNCTIONS			
Switch #	Switch Function	OFF (down)	ON (up)
1	Characteristic	Linear	Equal percentage*
2	Control signal	0 to 10 Vdc*	2 to 10 Vdc or 4 to 20 mA
3	Volts or mA	0(2) to 10 Vdc*	4 to 20 mA

\* Factory setting: equal percentage valve characteristic, 4-20 mA control signal.



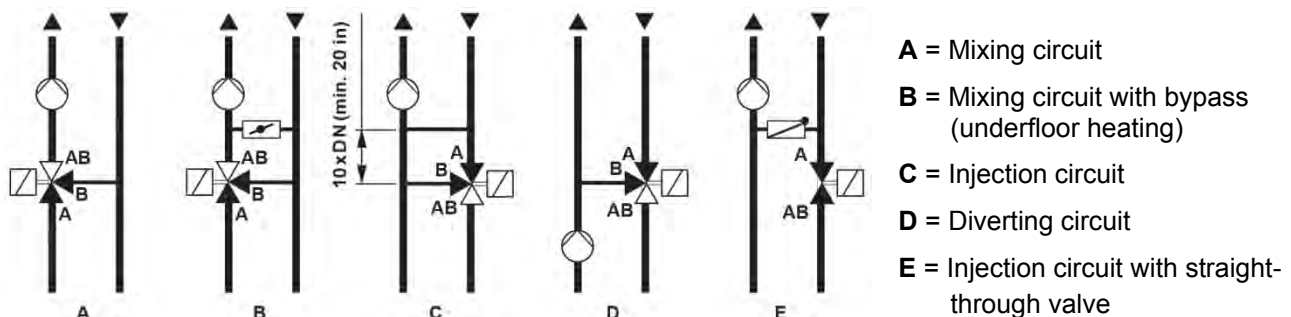
**FIGURE 3-4: 3-Way Control Valve DIP Switch Functions**

The 3-Way Control Valves are factory-calibrated at 0% and 100% stroke. When commissioning the valves (especially under extreme usage conditions), there may still be some leakage via control path A → AB with a 0% stroke control signal (4 mA). In this case, the valve can be recalibrated as follows:

- Use a pin or paper clip to push the button in opening (A) in the terminal housing.
- During calibration, the LED light (B) in the electronics module will flash green for approximately 10 seconds. The valve will be briefly closed and fully opened.

**CAUTION!**

This valve is suitable for straight-through normally closed or three-way applications only, and should be installed only in a mixing arrangement.

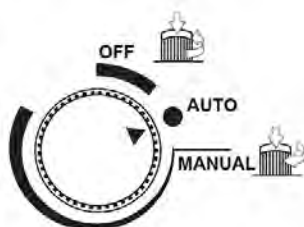


**SECTION 3: OPERATION AND CONTROLS**

**FIGURE 3-5: 3-Way Control Valve Hydraulic Circuits Application Example**

### 3.5.3 Auto and Manual Control (3-Way Control Valve)

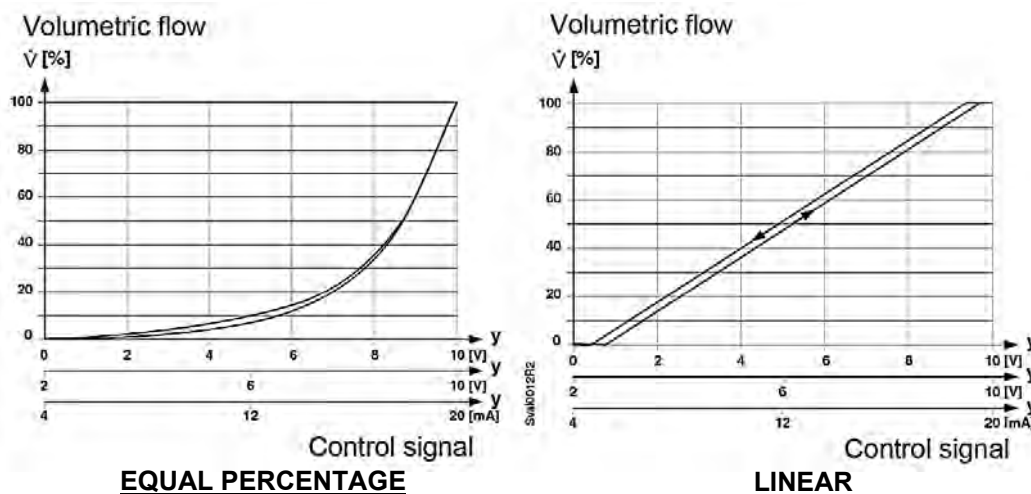
The 3-Way Control Valve Automatic and Manual control modes can be selected using the knob shown in Figure 3-6.



**FIGURE 3-6: Selecting AUTO or MANUAL Control**

#### 3.5.3.1 AUTO Control

The control signal is converted by the microprocessor in the electronics module into an output signal that generates a magnetic field in the core. This causes the only moving part, the armature, to change its position in accordance with the interacting forces (magnetic field, counter-spring, hydraulics, and so on). The armature responds rapidly to any change in signal, transferring the corresponding movement directly to the control disc, enabling fast changes in load to be corrected quickly and accurately. The valve position is measured continuously. The positioning controller ensures an exactly proportional relationship between the control signal and the valve stroke.



**FIGURE 3-7: Valve Characteristics - Equal Percentage (L) and Linear (R)**

In the event of a power failure, or if the power is switched off, the spring force closes the valve automatically (control path ports A → AB normally closed).

#### 3.5.3.2 Manual Control

The valve control path (ports A → AB) can be opened mechanically up to 95% of the full stroke by pressing the knob inward and turning it clockwise (to the MANUAL position). This disables the control signal from the controller.

To disable automatic control of the valve, press the knob (Figure 3-6) inward and turn it

## SECTION 3: OPERATION AND CONTROLS

counterclockwise (to the OFF position). The valve will close.

For automatic control, the knob (Fig. 3-6) must be set to the AUTO position (knob will spring out).

### **WARNING!**

The valve knob (Figure 3-6) **MUST** be set to AUTO position for proper operation of the LP Series unit.

### 3.5.4 3-Way Controller Status LED Indication

Open the electronics module of the 3-Way Controller Valve to view the two-color LED display, which indicates the operating status of the valve. The table below identifies what the behavior and color of the LEDs indicate.

3-WAY CONTROL VALVE STATUS LEDs		
LED Display	Status	Description
Green LED	On continuously	Automatic mode: Auto (normal, no faults)
	Flashing	<ul style="list-style-type: none"> <li>– Mechanically set to MANUAL</li> <li>– Mechanically set to OFF</li> <li>– Currently in auto-calibration mode</li> </ul>
Red LED	On continuously	<ul style="list-style-type: none"> <li>– General fault</li> <li>– General calibration fault</li> <li>– Microcontroller fault</li> </ul>
	Flashing	– Faulty 24 VAC supply (or low power)
LED Off		<ul style="list-style-type: none"> <li>– No 24 VAC supply</li> <li>– Fault with electronics module</li> </ul>

The LED will typically ~~only~~ assume only the conditions in this table (continuously red or green, flashing red or green, or off).

## 3.6 PREPARATION OF UNIT FOR OPERATION

It is important to make sure that the unit is installed and all piping and electrical connections are made per instructions in Chapter 2. Also make sure that the connecting piping has been cleaned out before starting up the unit.

## 3.7 UNIT STARTUP PROCEDURES

Follow the instructions below to start up the LP Series unit:

**SECTION 3: OPERATION AND CONTROLS****➤ UNIT STARTUP PROCEDURE INSTRUCTIONS**

- 1) Assure that all manual shutoff valves on boiler water/high temperature hot water and domestic water lines are closed.
- 2) Slowly open the manual shutoff valve on the cold water inlet line, checking to ensure that there are no leaks at the valve or any joints.
- 3) Adjust the operating temperature control to the desired temperature. Refer to Section 3.10 and Section 3.11 for the exact location of controls and detailed adjusting procedure.
- 4) Adjust the high temperature limit per actual operating conditions. It is normally factory set at 20°F above the setpoint, which is default 140°F operating supply water temperature.
- 5) Open the boiler water/ HTHW return valve.
- 6) Slowly open the manual shutoff valves on the power source inlet.

**NOTE:**

This procedure is similar for both boiler water and high temperature water energy sources.

**CAUTION!**

Boiler water and high temperature water present situations that can be very dangerous because of the high temperatures and pressures. Use common sense, and follow all accepted and recommended procedures when performing installation, operation, and maintenance procedures, to avoid possible injury or death.

- 7) If no leaks are found, slowly continue to open the manual shutoff valves on the power source inlet.
- 8) As the unit is initially heating the water, carefully re-inspect the water inlet, the water outlet, power source inlet (boiler water or high temperature water), and boiler water return lines and joints for signs of leakage.
- 9) As unit approaches the desired operating temperature, check that the temperature on the unit is within the desired range. If necessary, readjust the temperature control valve. See the Submittal documents and the temperature control valve component manual, included with the unit, for the exact location of the valve and detailed adjusting procedures.
- 10) After the unit has reached operating temperature, re-inspect all joints for signs of leakage. In addition, check all gauges and controls to verify that the energy source pressures are within design specification.
- 11) The unit is now ready for normal operation. Proceed to Section 3.7 for setting the temperature and other initial startup parameters using the controller.

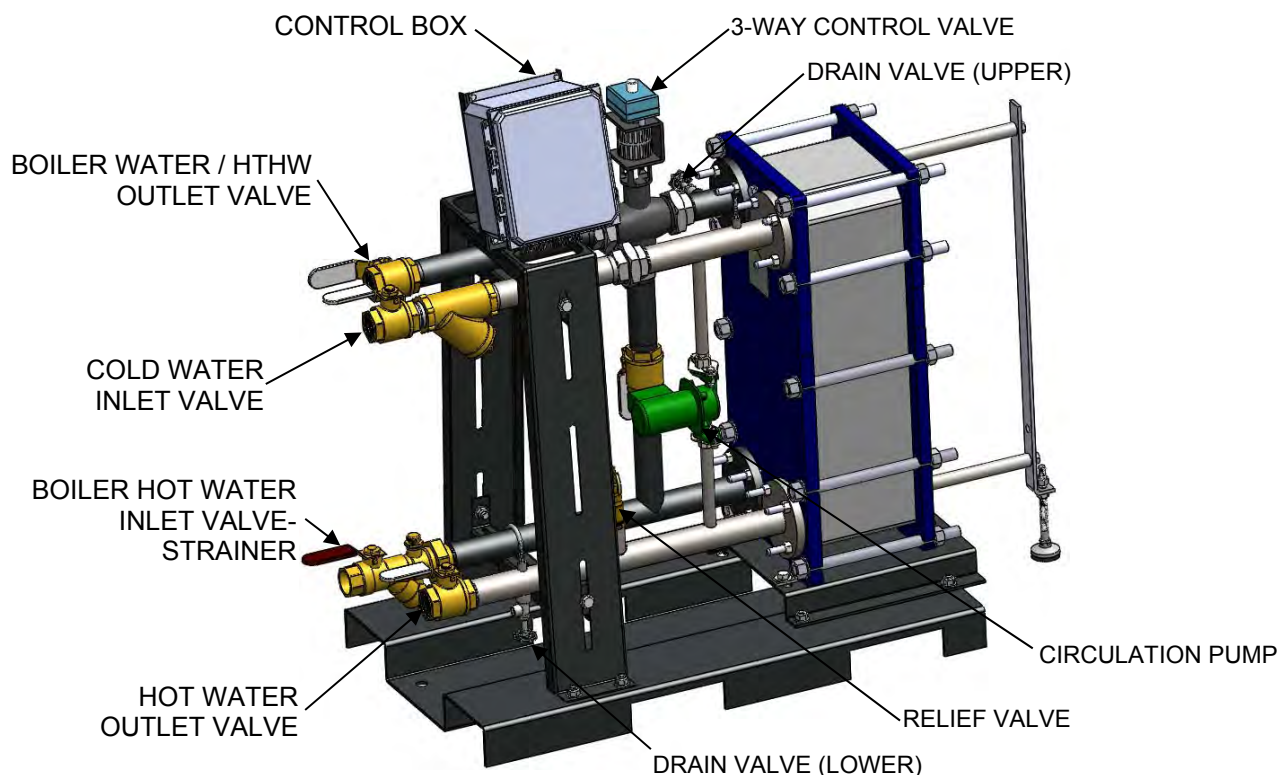
**SECTION 3: OPERATION AND CONTROLS****3.8 UNIT SHUTDOWN PROCEDURES**

All maintenance procedures require the water heater to be properly shut down. Follow the instructions below in order to shut down the LP Series unit:

**➤ UNIT SHUTDOWN PROCEDURE INSTRUCTIONS**

1. Close all valves in the energy source inlet line (boiler water or high temperature water).
2. Turn off all power to the electric control.
3. When possible, relieve the pressure from energy source line (boiler water or high temperature water), between the shutoff valve and the unit.
4. Wait 5 minutes or until dial thermometer starts dropping. Close all remaining valves in the system in this order.
  - a. Hot water outlet line
  - b. Cold water inlet line
  - c. Boiler/high temperature water return line.
5. After the system has cooled, drain the unit by opening the heat exchanger drain valve and holding the relief valve in the open position. This will prevent the formation of a vacuum and increase the drainage flow.
6. Proceed with the required maintenance or repairs.
7. After performing the required maintenance or repairs, return the unit to operation by following the startup procedures described above in Section 3.7.

**SECTION 3: OPERATION AND CONTROLS**



**LP SERIES STARTUP / SHUTDOWN COMPONENTS**

### 3.9 CONTROLLER INTRODUCTION

The LAARS Water Heater Controller is a microprocessor based, state-of-the-art, device offering unmatched performance and full user configurability through LCD interface for water heating applications.

It is used with type 'J' thermocouple sensor.

Menu based programming, all parameters and setpoints are user configurable via menu prompts. All aspects of the unit are user configurable through the interface on PID controller display.

Utilizes 1/8 DIN advanced programmable PID temperature controller factory configured for full range of math, logic, totalizer and specialized functions required for single loop process and temperature control of water heating applications.

**MODBUS RTU®:** RS485 Network allows single or multiple units to be connected together for distributed applications, remote monitoring SCADA applications (optional).

**MODBUS TCP/IP** and **BACnet UDP/IP:** Ethernet Network allows single or multiple units to be connected for distributed applications, remote monitoring SCADA applications (optional). Ethernet port is available on the rear side of the temperature controller.



## SECTION 3: OPERATION AND CONTROLS

Optional building automation communication gateway is also available for connections with other protocols.

### 3.9.1 PID Controller Overview

This section shows the description of the display and button functions of the controller, which may be required for backup interface when HMI is being replaced or repaired.



#### General Description of Operator Buttons:

Temperature Controller has six buttons (four navigation and two function) available as shown in following button layout:



#### Button Operation

- **Raise:** The raise button increments parameter values to limits.
- **Lower:** The lower button decrements parameter values to limits.
- **Page:** In Operator levels 1 or 2, the Page button will select between the Home display or

**SECTION 3: OPERATION AND CONTROLS**

the Programmer Edit and Run lists (if one of the programmer features is enabled).

In Levels 3 or Config the Page button will scroll through list headers (no auto-repeat). If the Page button is pressed within a list, the display reverts to the top of the list. The top of the list shows only the list header with no initial parameters.

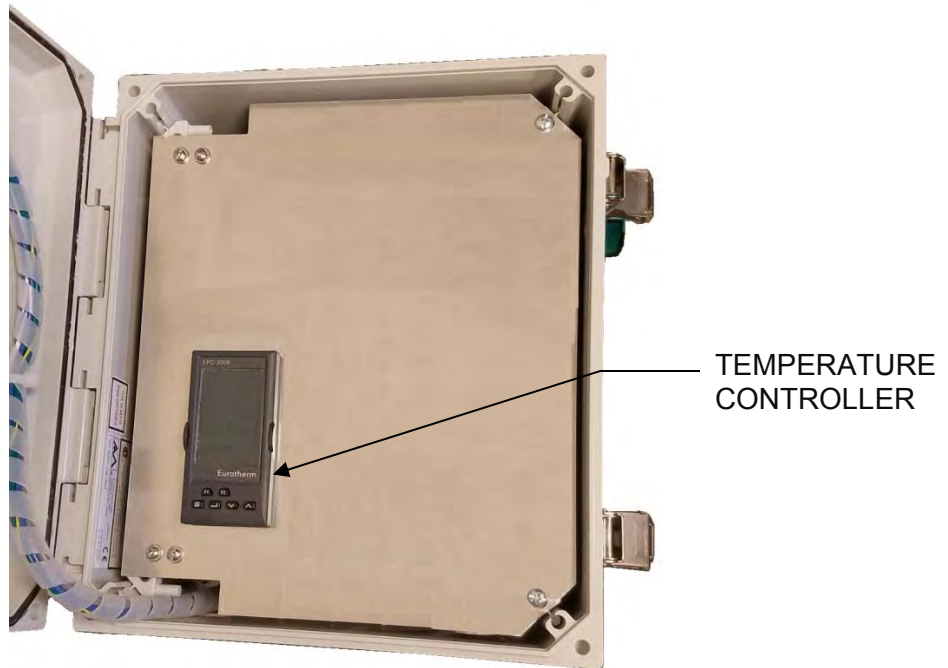
- **Page (held for >3 seconds):** The Goto parameter is selected directly. This operation can be performed from any display. If the Page is held for >3 seconds at power-up, the Quick Start Mode is selected following the entry of a passcode.
- **Page+Raise:** Scroll back the list headers (with auto-repeat).
- **Scroll:** Select parameters in turn, returning to the first parameter in the list or to a list header if Level 3 or Configuration level is selected. If the button is held down the list will auto-repeat. In levels 1 and 2 this button also scrolls through promoted parameters when the HOME screen is selected.
- **Scroll+Raise:** Scroll back through parameters from bottom to top (with auto-repeat).
- **Page+Scroll - all variants:** Jump directly to the "HOME page." The current operating level remains unchanged. If the HOME page is already selected, these buttons will perform the custom function. The default is Alarm Acknowledge.
- **Raise+Lower (Run/Hold):** If a programmer option is enabled and a program is configured, a momentary press of these keys toggles between Run and Hold modes.
- **Raise+Lower (hold for >3 seconds - Mode):** If a programmer option is enabled, and a configured program is running, holding these buttons will abort the program. If the HOME page is selected, and the Programmer is not running, holding these buttons will invoke the 'Mode' display where the Loop Mode parameter will allow selection of Auto or Manual mode.
- **F1 and F2:** the functionality of these buttons is set by the Instrument function block. The default settings are:
  - F1: Auto/Man
  - F2: Run/Hold

**NOTE:**

A time-out applies to all displays. If no button presses are detected within a timeout period (default is 30 min.), the display will revert back to the "HOME screen."

**SECTION 3: OPERATION AND CONTROLS**

**3.10 CONTROLS STARTUP**



**LP SERIES CONTROL PANEL FRONT  
PID CONTROLLER**

## SECTION 3: OPERATION AND CONTROLS

### 3.11 DATA COMMUNICATIONS

LP Series Water heater control system allows the controller to communicate with external Building Automation System (BAS) or Energy Management System (EMS). It is compatible with standard Modbus RTU or TCP/IP and BACnet UDP/IP multi-protocols without the need for external gateway. Optional gateway is also available for communications with other protocols.

- Communication between HMI and Temperature controller is standard Modbus RTU.
- Use RJ45 port to connect PC or network computer system with PID controller.

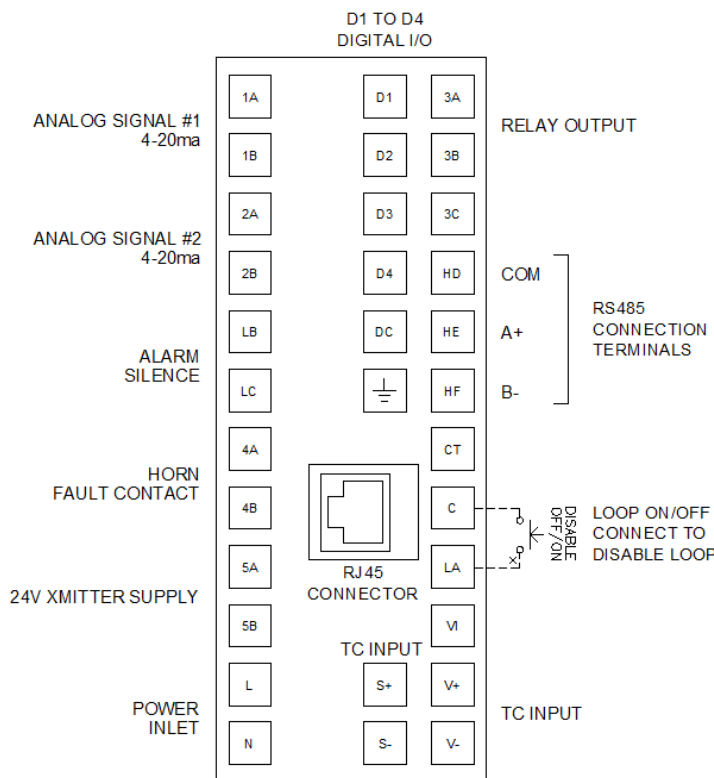
#### **WARNING!**

- Maximum communication cable lengths without repeater  
RS485 Network – 4,000 feet  
Ethernet Network – 328 feet
- Communications and power wiring should never be routed together inside same conduit because it can cause nuisance related issues on communications side.

#### NOTES:

- To help prevent ground loops, the cable shield should be grounded at one point only.
- Use twisted, shielded-pair communication wiring.

#### 3.11.1 Temperature Controller Terminals Layout



**SECTION 3: OPERATION AND CONTROLS****3.11.2 LAARS controller communication features**

---

1. LAARS controller auto-detect the protocol of Modbus TCP/IP, BACnet UDP/IP.
  - a. The two protocols share the same IP addresses, Subnet masks, default gateways.
  - b. Auto-Discovery Mode – known as Zero-configuration networking (zeroconf)
    - i. Utilized Bonjour Service released by Apple under a terms-of-limited-use license.
    - ii. It is intended to use with itools (Eurotherm), not third party applications
    - iii. For cybersecurity reasons, the Bonjour™ service is disabled by default, as enabled service makes it easier for a malicious user to discover and access the controller via the network.
  - c. DHCP Mode
    - i. Default: OFF
    - ii. Enabling DHCP will auto-configure IP address, Subnet Masks, default gateway.
    - iii. Dynamic IP addressing.
  - d. Static Mode
    - i. Default: ON
    - ii. User can manually set up IP address, Subnet Masks, default gateway.
2. Ability to connect through Modbus RTU protocol.

**3.11.3 LAARS Default Settings Summary for communication**

---

1. Auto-detection of Modbus TCP/IP, BACnet UDP/IP protocols, when connecting RJ45 port on the controller.
  - a. Default Mode: Static (Need to manually set parameters)
  - b. Default IP: 192.168.111.222
  - c. Default Mask: 255.255.255.0
  - d. Default Gateway: 0.0.0.0
  - e. Mac is read-only (Introduced in the instruction)
2. Ability to connect to Modbus RTU when wiring to HD (COM), HE (A+), HF (B-).
  - a. Default Baud Rate:19200
  - b. Default Parity: None
  - c. Default Data Length: 8
  - d. Default Stop Bits: 1
  - e. Default Slave ID: 1

### 3.11.4 Modbus RTU Communication Wiring

Up to 32 units can be connected in a daisy chain network including BAS Master.

The diagram illustrates the RS-485 connection between an RS-485 MASTER and a PID CONTROLLER. The master's terminals are DATA (A+), DATA (B-), and GND. The controller's terminals are HD (COM), HE (A+), and HF (B-). The wiring is as follows:

- WHITE** wire connects the master's **GND** terminal to the controller's **HD** terminal (labeled **COM**).
- RED (+)** wire connects the master's **DATA (A+)** terminal to the controller's **HE** terminal (labeled **A+**).
- BLACK (-)** wire connects the master's **DATA (B-)** terminal to the controller's **HF** terminal (labeled **B-**).

[illegible]

**SECTION 3: OPERATION AND CONTROLS**
**3.11.5 Modbus/BACnet Data Addresses and Points**

Item Description	Type	Modbus Address	BACnet Address	Register	Comments
Remote/Local Setpoint	float32	2	Analog Value #38	RW	40-180°F Range (140°F Default)
Unit Remote On/Off	float32	277	Analog Value #53	RW	0: Off 1: On
Outlet Water Temperature	float32	289	Analog Input #1	RO	40-205°F Range
Mixed Inlet Water Temperature	float32	290	Analog Input #2	RO	40-205°F Range
Control Valve Open %age	float32	4	Analog Input #10	RO	0-100% Range
High Temperature Alarm Status	bool	2149	Binary Input #10	RO	0: Off 1: On (Default 20°F above Setpoint)
Low Temperature Alarm Status	bool	2245	Binary Input #14	RO	0: Off 1: On (Default 20°F below Setpoint)
Outlet Sensor Status	Unit8	1932	MSI#1	RO	0: Good 1: Fail
Inlet Sensor Status	Unit8	1948	MSI#2	RO	0: Good 1: Fail

**Notes:**

1. Modbus decimal address is offset from 400001
2. Abbreviations
  - a. RO – Read Only
  - b. RW – Read/Write




**SECTION 3: OPERATION AND CONTROLS****3.11.6 Instructions to Change Communication Settings Manually****IP addresses, Subnet Masks and default gateway****CAUTION!**

- Do not go to the configuration menu while the controller is operating the water heater.
- Do not power off the controller without completing all the steps in the configuration settings. Save and go back to the main screen.
- Configurations settings shall be performed only by trained and experienced personnel.
- Proper care must be taken to prevent any changes to other settings in the configurations.

**Refer to following steps:**


1. Open the front door on the control panel box in order to access the temperature controller main screen which is shown below:




2. Press and hold page button  on the main screen until following screen appears:




**SECTION 3: OPERATION AND CONTROLS**

3. Now release the button. Again press and hold page button  until following screen appears:




4. Use raise and lower  buttons in the next step to navigate to the following screen:



5. Click on scroll button  and you will see passcode screen as shown below:



## SECTION 3: OPERATION AND CONTROLS

6. Click on scroll button  again to move to the next digit, and use arrow buttons




to select the passcode. The default passcode is **0004**.

7. If the entered passcode is correct, it will direct to configuration menu screen:



8. Now click on page button  and you will see following screen:



9. Click on page button  until "COmm" appears on the screen:





**SECTION 3: OPERATION AND CONTROLS**

10. In order to change the appropriate communication settings:
  - a. **Modbus RTU settings** - refer to steps 11 and 12 below. Then jump to step 23.
  - b. **Modbus/BACnet IP settings** - refer to steps 13 through 25. Ignore steps 11 and 12 below.


11. Click on scroll  button and you will see F.COM:



From the sub-menu, you are able to set up the parameters for Modbus RTU.

12. Now click on scroll  button and then click on raise  button to select



- Then click on scroll  and you will see the following parameters for Modbus RTU:

- a.  Default Baud rate: 19200

- b. Click on scroll  button

- c.  Default Parity: None

- d. Click on scroll  button

- e.  Slave node. Default: 1

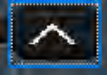


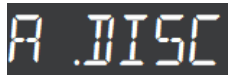
Use the raise and/or lower arrow  buttons to change the parameters.

Jump to step 23 in order to save the settings.

**SECTION 3: OPERATION AND CONTROLS**

13. Click on scroll button  and you will see “mAIN” screen:





14. Click on raise button  to select , then click on scroll button , and you will see  (Auto-discovery mode):



\*Default is OFF.

15. Click on  to move to the IP.MODE. Use arrow button to switch the mode:

- a.  is static mode – IP, Gateway, Subnet masks shall be manually setup
- b.  is DHCP mode – DHCP server shall be setup to assign IP, etc.

**SECTION 3: OPERATION AND CONTROLS**




16. Click  to move to set up IP addresses. You will see the screen:



- a.
- b. Use arrow buttons to change the IP addresses if required.



17. Continue to click  to see subnet masks (Indicator: IP.S1, IP.S2, IP.S3, IP.S4):

- a. Use arrow buttons to change the subnet masks if required.



18. Continue to click  to see default gateway (Indicator: IP.G1, IP.G2, IP.G3, IP.G4):

- a. Use arrow buttons to change the default gateway if required.



19. Continue to click on  to see mac addresses.



20. After setup, click  until you see:



21. Click arrow button until you see the screen below for BACnet setting




## SECTION 3: OPERATION AND CONTROLS

22. Click  to see parameter device ID for BACnet:



Use the arrow buttons to change device ID if required.

23. After the setup is complete, press and hold button , until the following screen appears:



24. Click on  to go back to the main screen and the settings will be saved.

25. Now the controller is ready for normal operation.

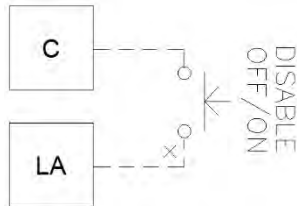
## SECTION 3: OPERATION AND CONTROLS

### 3.12 DRY CONTACTS

The following two types of contacts are available for remote monitoring of unit:

#### 3.12.1 Contact closure input (enable/disable)

Dry Contacts C and LA are available on the PID temperature controller to remotely start/stop the unit if required.

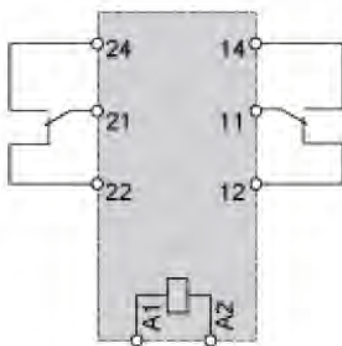


This input is supplied with the current transformer. Contact closure on the remote switch disable (stop) the unit.

#### 3.12.2 Fault Relay Contacts

Fault relay R1 terminals 11 and 14 shown below (also shown in Section 6.4) available on the terminal block inside the control panel box for remote alarm indication purposes. This relay is a Double Pole Double Throw (DPDT) type which energizes when fault condition occurs. Fault can be cleared by pressing the Alarm Silence button.

It has one set of normally open contacts (between contacts 11 and 14 and 21 and 24) and normally closed contacts (between contacts 11 and 12 and 21 and 22). Normally open (NO) contacts are rated for 8 amps and maximum switching voltage is 400 VAC.





**SECTION 4: MAINTENANCE****SECTION 4: MAINTENANCE****CAUTION!**

All service on the LP Series water heaters must be performed by trained and experienced technicians from appropriate service agencies.

This section covers the service and maintenance for LP Series water heaters and provides instructions for the inspection and replacement of critical parts and components.

Any questions concerning maintenance procedures should be directed to your local rep of the LAARS Factory. Please be prepared with model and serial numbers of the unit and heat exchanger coils prior to contacting.

**NOTE:**

Taking the unit offline is required for many of the maintenance procedures in this section, so all technicians performing maintenance should be familiar with the procedures necessary for unit shutdown (Section 3.8) and unit startup (Section 3.7).

Any component(s) directly connected or linked to the component being replaced should carefully be examined before maintenance procedures are started. If any of the related components show signs of wear or improper operation, they should be considered for replacement at the same time.

**SECTION 4: MAINTENANCE****4.1 CIRCULATING PUMP MAINTENANCE**

LP Series water heaters are equipped with a circulating pump to assist in the even heating of the water. If the unit is equipped with a circulating pump, the following procedure should be followed to replace the pump.

**➤ CIRCULATING PUMP INSPECTION & REPLACE INSTRUCTIONS**

- 1) Take the unit offline (Steps: 1 through 5 of the shutdown procedure, Sec. 3.8) before attempting to service the circulating pump.

**WARNING!**

**TURN OFF/DISCONNECT ALL ELECTRIC POWER BEFORE ATTEMPTING ANY MAINTENANCE PROCEDURE.**

- 2) Test the pump according to manufacturer's instructions supplied with the test unit. If found to be defective or worn, replace the pump per the following steps:
  - a) After assuring that the power has been turned off, disconnect the electric leads to the circulating pump.
  - b) Drain the unit by opening the drain valves (See Figures 3-1a and 3-1b).
  - c) Break the flanged joint between the pump and the inlet and outlet piping.
  - d) Remove the pump.
  - e) Reconnect the pump to the inlet and outlet piping. Follow recommendations contained in the manufacturer's documentation, local codes, or accepted contractor practices as to the use and/or type of joint compounds or sealer at the connections.
  - f) Reconnect the electric leads to the pump (reference wiring diagram provided with the unit to assure proper wiring).
  - g) Follow the startup procedures (Section 3.1) to put the unit back online. Carefully check all connections for any sign of leakage.

**SECTION 4: MAINTENANCE****4.2 POWER CONNECTION REWIRING**

If any of the power connections must be rewired at the electrically activated controls or junction boxes, follow the steps listed below.

**➤ POWER CONNECTION REWIRING INSTRUCTIONS**

- 1) Follow Steps 1 through 5 of the shutdown procedure (Sec. 3.8) to take the unit offline before attempting any electrical service.

**WARNING!**

**TURN OFF/DISCONNECT ALL ELECTRIC POWER BEFORE ATTEMPTING ANY MAINTENANCE PROCEDURE.**

- 2) After assuring the power has been turned off, disconnect and rewire the electrical connection in question. Refer to Section 6.4 for wiring details.
- 3) Turn the power on to check that the component that has been rewired is functioning properly.
- 4) Follow the startup procedure instructions in Section 3.7 of this manual to return the unit to operation.

## SECTION 4: MAINTENANCE

### 4.3 PLATE HEAT EXCHANGER MAINTENANCE

This section describes how to clean and maintain the LP Series heat exchangers, including disassembly and inspection instructions for the Plate and Frame heat exchangers.

#### 4.3.1 General Heat Exchanger Maintenance Procedures

- Every six months to one year check temperatures and flows against the commissioning data.
- Check general condition and look for any signs of leakage.
- Wipe clean all painted parts and check surfaces for signs of damage.
- Check bolts and bars for rust and clean.
- Lightly coat threaded parts with molybdenum grease or a corrosion inhibitor (ensure that no grease, etc., falls onto the plate gaskets).

#### 4.3.2 Clean-In-Place (CIP) Cleaning

CIP cleaning is preferable when the scaling deposits on the plates are soluble. When CIP cleaning is used routinely, intervals between heavier maintenance is extended and gasket life is improved.

Two suggestions for cleaning solutions appropriate for plate and frame heat exchangers are listed below:

DEPOSIT TYPE	SOLUTION
<b>Organic materials and grease</b>	<b>Sodium Hydroxide (NaOH)</b> <ul style="list-style-type: none"> <li>• Maximum concentration = 1.5%</li> <li>• Max. Temp. = 185 °C.</li> <li>• Mixture for 1.5% concentration = 1.32086 gallon.</li> <li>• 30% NaOH per 26.4 gallon water</li> </ul>
<b>Limestone and other minerals</b>	<b>Nitric Acid (HNO<sub>3</sub>)</b> <ul style="list-style-type: none"> <li>• Maximum concentration = 1.5 %</li> <li>• Max. Temp. = 149 °C.</li> <li>• Mixture for 1.5% concentration = 2.4 ltr.</li> <li>• HNO<sub>3</sub> 62% per 0.63 gallon water</li> <li>• Nitric acid also has an affective build up effect on the passivation film of stainless steel.</li> </ul>

#### CAUTION!

- Nitric acid and Sodium Hydroxide may cause injury to exposed skin, eyes, and mucous membranes. Use of protective eyewear and gloves is strongly recommended.
- Under no circumstances should hydrochloric acid be used to clean stainless steel plates, nor should hydrofluoric acid be used to clean titanium plates.

Instructions for use of a CIP system are on the next page.

### ➤ CIP CLEANING INSTRUCTIONS

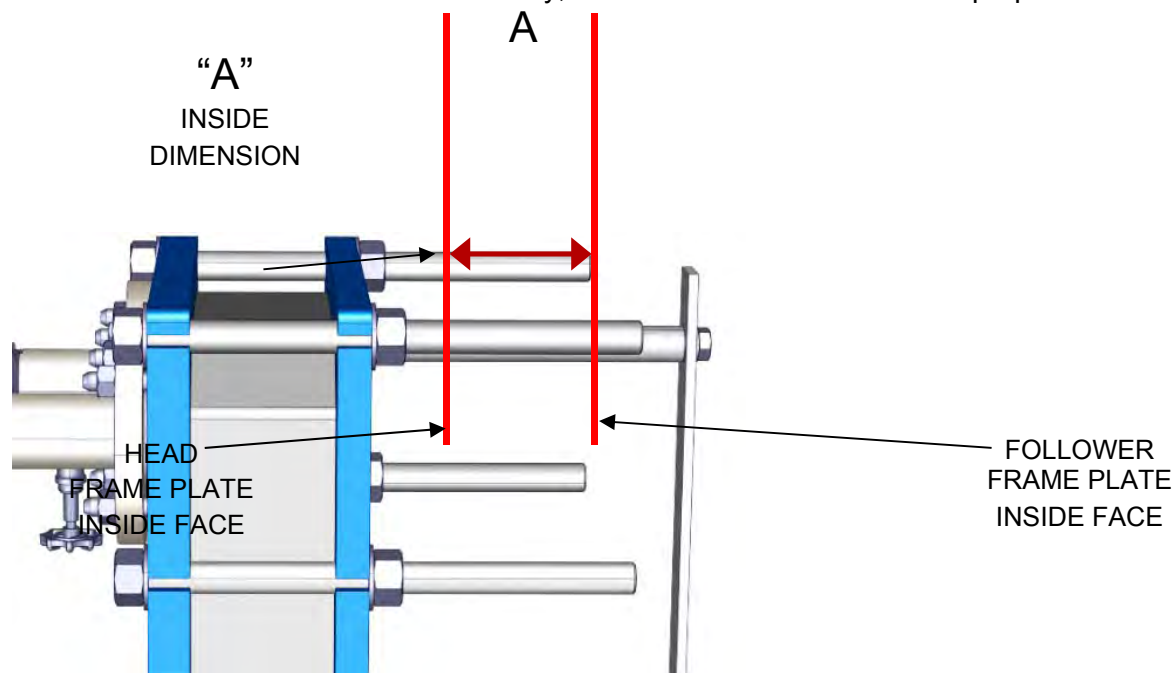
**SECTION 4: MAINTENANCE****NOTES:**

- Choose a cleaning product appropriate for the materials used in the system that will come into contact with the cleaner. Follow all manufacturer's instructions when using any cleaning agent.
- 1) Isolate the heat exchanger from the system and connect the CIP unit to the heat exchanger with the flow direction opposite to normal operation.
  - 2) Dilute and mix the cleaning agent with the CIP tank water according to the manufacturer's instructions, and heat to the required temperature.
  - 3) The cleaning agent should be circulated through the system at the fastest flow rate available (10% to 20% above normal), but at the least should be at the normal operational flow rate.
  - 4) Circulate the cleaning solution for at least 30 minutes and up to 4 to 6 hours. If possible, reverse the flow direction every 30 minutes.
  - 5) After the cleaning interval, always rinse the system thoroughly with fresh water. Circulate fresh water through the system for at least 10 minutes after the cleaning operation. A solution of 1-2% sodium hydroxide (NaOH) or sodium bicarbonate (NaHCO<sub>3</sub>) before the final rinse ensures that all acid is neutralized.
  - 6) Disconnect the CIP unit from the heat exchanger.
  - 7) Check the performance of the water heater against the data provided in the equipment manifest, such as the pressure drop data. Compare to pre-cleaning results. Noted performance differences can be used to trigger future maintenance.
  - 8) Responsibly dispose of used cleaning chemicals.

When CIP cleaning is not appropriate, then it may be necessary to disassemble the Plate and Frame heat exchanger to access the plates directly for cleaning.

**SECTION 4: MAINTENANCE**

**IMPORTANT!** The distance between the inside faces of the Follower frame plate and the Head frame plate ("A" in Figure 4-1) is listed in the service contract. If unavailable, then carefully measure and record it before disassembly, as this dimension is critical for proper reassembly.



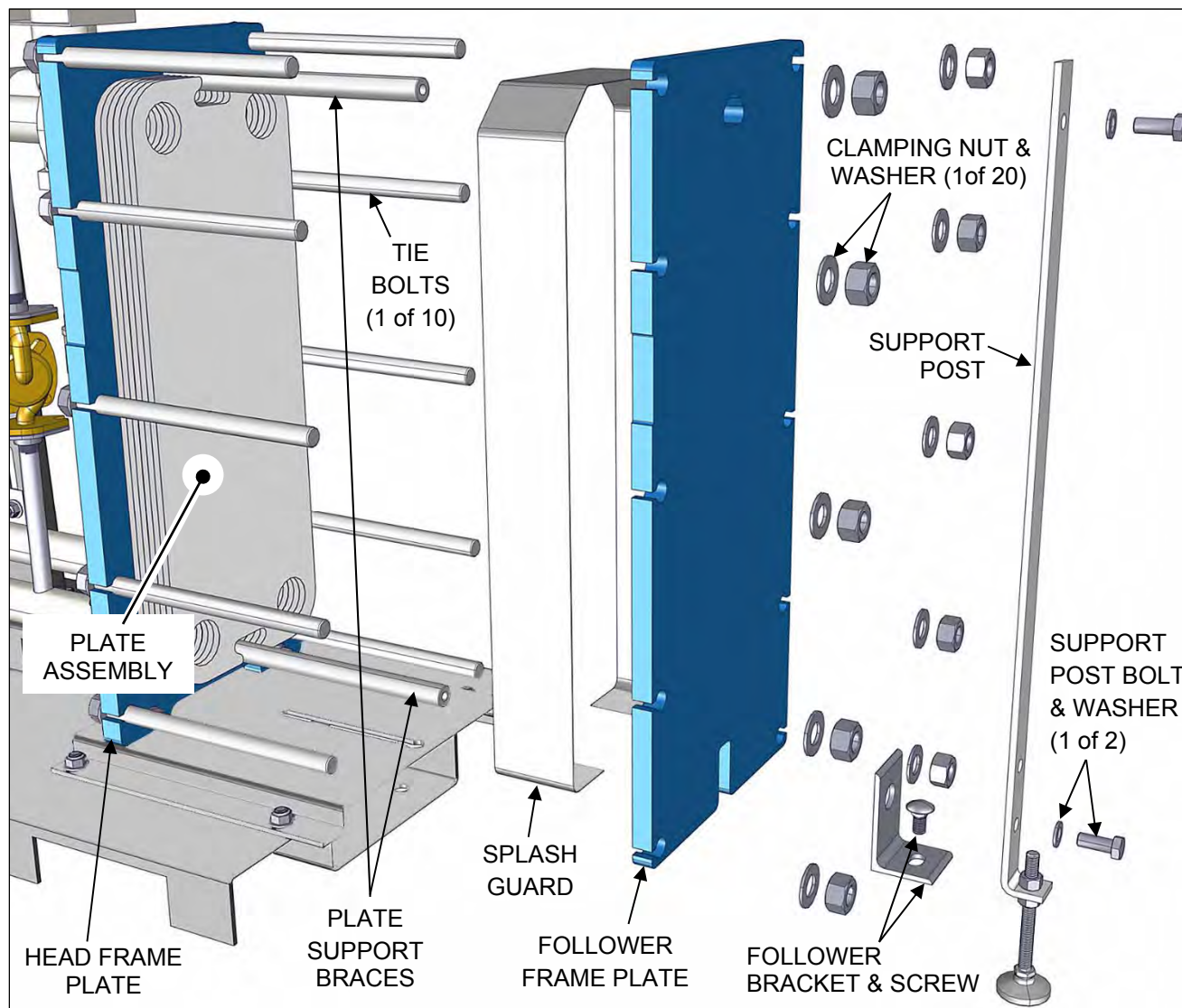
**FIGURE 4-1: Critical Dimension "A"**

## SECTION 4: MAINTENANCE

To disassemble the heat exchanger and access the plate assembly for cleaning or replacement, refer to Figure 4-2 and to the instructions that follow. Parts in Figure 4-2 are labeled according to the nomenclature used in the disassembly instructions on the next page.

**NOTE:**

Figure 4-2 is for part identification only and is not meant to accurately portray the plate assembly.



**FIGURE 4-2: Plate and Frame Heat Exchanger Parts**

**CAUTION!**

Only technically qualified persons are allowed to disassemble and perform maintenance on this heat exchanger.

## SECTION 4: MAINTENANCE

Below are the instructions for disassembly and inspection of the Plate and Frame heat exchanger.

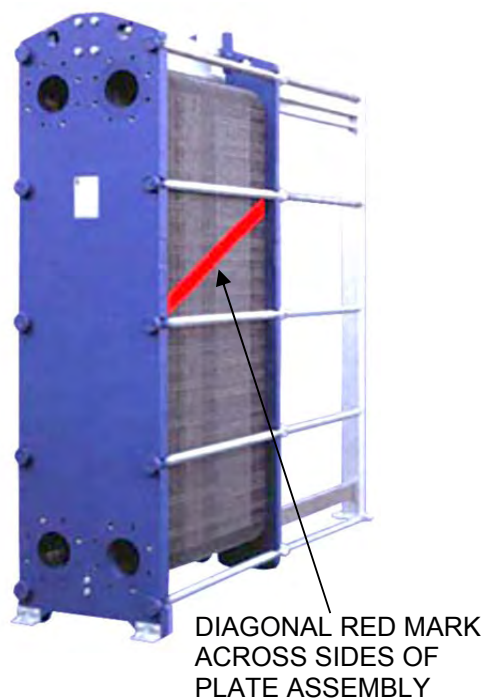
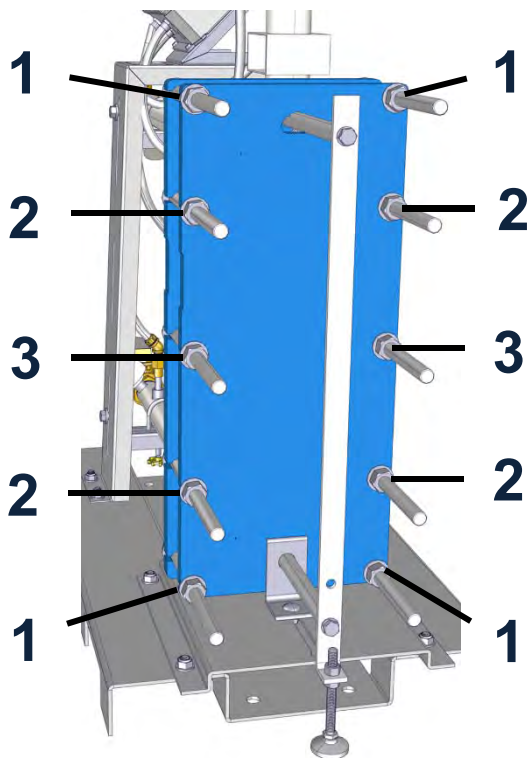
### ➤ HEX DIASSEMBLY and CLEANING

1. Shut down the heat exchanger as described in Section 3.8.
2. Shut off all water connections.
3. Shut off all power to the unit.
4. Ensure to bleed all pressure from all parts of the unit. Open drain valves.
5. Make sure the heat exchanger cools down to below 104 °C; with EPDM < 219.2 °C.
6. Clean the exposed threads of the ten clamping bolts (Figure 4-1) and grease them.

#### CAUTION!

To prevent personal injury, ensure unit is depressurized and drained of all hot fluids before attempting to open the heat exchanger.

7. Loosen the clamping nuts affixing the bolts in the Follower frame plate in the order shown in Figure 4-3a.
8. Unclamp as uniformly as possible by turning alternating bolts based on the bolt opening order, thus keeping the frames and plates parallel throughout the operation. Avoid allowing the frame plates to be skewed by more than 5 mm.



**FIGURE 4-3a: Bolt Loosening Order      FIGURE 4-3b: Marking Plates w/ Red Line**

9. Remove the upper and lower Support Post Bolts, washers, and support post (Figure 4-2) and set aside for reassembly.



**SECTION 4: MAINTENANCE**

10. Remove the Follower Bracket and Screw (Fig. 4-2) and set aside for reassembly.
11. Pull the Follower frame plate back far enough to expose the internal Plate Assembly (Fig. 4-2).
12. Remove the Splash Guard (Fig. 4-2), and set aside for reassembly.

**NOTE:**

The plates must be reassembled in the exact order and configuration, so the order should be recorded or plates marked to ensure proper configuration during reassembly. It is suggested to mark the plates with a diagonal line, as shown in Figure 4-3b in order to easily record proper order and orientation of the plates.

**4.3.2.1 Cleaning the Plates****CAUTION!**

Always wear gloves and eye goggles when using cleaning detergents.

- Consult a cleaning specialist for a suitable choice of detergent. Ensure that all detergents used are compatible with the plate and gasket material before use.
- If plates are removed for manual cleaning, make sure they are re-fitted in the exact same order and orientation when refitted.
- Use ONLY nylon or other types of “soft” scrubbing brushes when cleaning the plates.
- The plates use gaskets to prevent contamination of the water being heated, and these must be removed in order to clean the plate properly. Use acetone or other types of solvents which do not contain chlorine to remove old gasket glue. Alternatively use an LP gas flame heating the reverse side of the plate. Do not use any other type of gas, which may produce a “harder” flame. Boiling water can be used with some success.
- For thick scaling or organic material, the plates may be submerged in a tank of appropriate cleaning agent in order to dissolve deposits and/or soften organic contamination.

**CAUTION!**

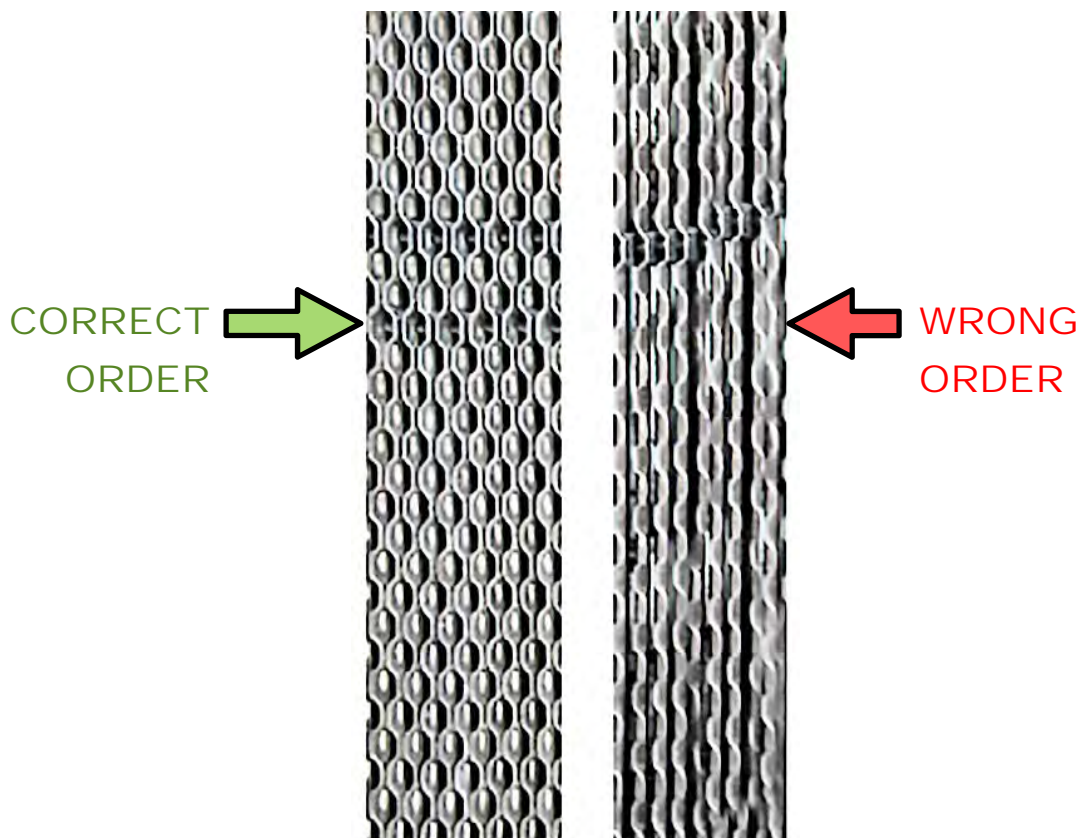
Never use a metal brush, steel wool, or sand/glass paper. This will damage the passivation film of the plates.

- A high pressure cleaner may be used, but care should be exercised and abrasives never used.
- Clean thoroughly. Insufficient cleaning may result in reduced water flow, lower thermal output, and shortened heat exchanger life expectancy.

**SECTION 4: MAINTENANCE****4.3.2.2 Plate Inspection and Replacement**

All plates must be clean, dry, and free from oil or grease for inspection. If there are any oil deposits on the gaskets, or on the gasket seating area, then there is a strong likelihood that the plates may slip out of place when the unit is being tightened. If the gaskets are contaminated with dirt or grit, then these could cause leakage.

- Make sure that all seating areas are flat, clean, and undamaged.
- If one plate is replaced, then each plate on either side must also be replaced.
- Always use new gaskets.
- Fit the plates according to the Plate Sequence Sheet – ensure all gaskets face towards the fixed/head frame plate.
- Alternate between left and right handed plates—if the plate edges form a regular honeycomb pattern, the left/right hand sequence is correct. See Figure 4-3 below.



**FIGURE 4-3: Determining Proper Alternating Plate Packing**

**SECTION 4: MAINTENANCE****4.3.3 Heat Exchanger Reassembly**

To reassemble the plate and frame heat exchanger refer to the instructions below.

**➤ HEAT EXCHANGER REASSEMBLY**

1. After the plate assembly is in order, refer to Figure 4-2 and instructions in Section 4.3.2 for identification of parts involved in the reassembly.
2. Lightly oil the threads of the tie bolts used for clamping the face plates together. Ensure that oil or grease do not get onto the gaskets or the gasket seating faces on the back of the plates.

Wet or contaminated plates can become misaligned during tightening. In that case, dismantle, clean, and dry all areas in contact with the gaskets.

3. Evenly tighten all bolts in the correct order (refer to Figure 4-2a). A ratchet spanner is advised for this use.

**CAUTION!**

Tightening the plate package can be done only with a fully depressurized unit.

4. Ensure clamping is as uniform as possible by alternating bolt turns, thus keeping the frames and plates parallel throughout the operation. Avoid skewing the frame plates by more than 5 mm.
5. Tightening is complete when the distance between the inside faces of both Follower and Head frame plates equals the "A" distance as shown in the datasheet or measurement (see Figure 4-1). This tightening distance can also be calculated using the following formula: Assembly distance = No. of plates x (plate thickness + coefficient) the coefficients vary depending on the model type. If in doubt, please check with the relevant LAARS Sales Office.
6. Finally check that all bolts are in tension and clean any spilled oil off the frame plates.
7. On completion the unit can be pressure tested (test pressure is stated on the name plate).
8. If dimension "A" is not reached with application of maximum tightening torque:
  - a) Check the number of plates and dimension A on the datasheet.
  - b) Check that all the nuts and bearing boxes are running freely. If not, clean and lubricate or replace.
9. If the unit does not fully seal, it may be tightened step by step to give dimension "A" min. This dimension is mentioned on the nameplate. The maximum tightening torque must not, however, be exceeded.

**CAUTION!**

**Under no circumstances should distance "A" be smaller than "A" min.**

10. Replace the Splash Guard, reassemble the Cover Bracket and Screw to the Follower Cover, and affix the Support Post to the Plate Support Braces at two places (see Figure 4-2).
11. After all adjustments have been made to satisfaction and all connections and fittings double checked, apply power and refer to **Section 3.47: Unit Startup Procedures** to

**SECTION 4: MAINTENANCE**

initiate operation of the unit.

12. Unit should be checked for leaks and correct pressure levels to ensure proper operation.

**4.4 T&P OR PRESSURE ONLY RELIEF VALVE REPLACEMENT**

If the water pressure or T&P relief valve mounted on the unit is not functioning correctly and must be replaced, follow the procedures outlined below.

**➤ T&P RELIEF VALVE REPLACEMENT INSTRUCTIONS**

- 1) Before performing this maintenance procedure, follow the shutdown procedure in Section 3.8 to take the unit offline.

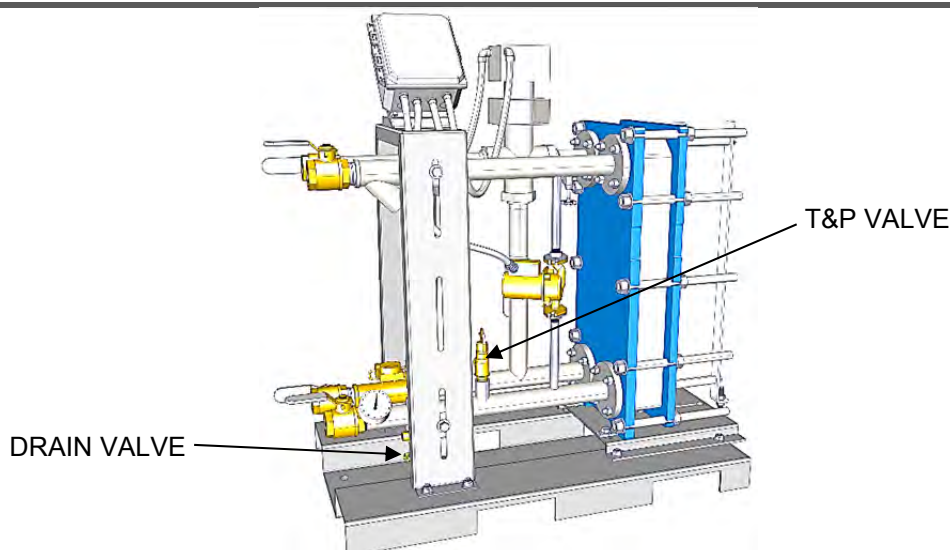
**WARNING!**

**TURN OFF/DISCONNECT ALL ELECTRIC POWER BEFORE ATTEMPTING ANY MAINTENANCE PROCEDURE.**

- 2) Carefully disconnect the drain line from the relief valve to the drain.
- 3) Unscrew and remove the T&P relief valve from its mounting location (Fig. 4-4).
- 4) Install the new relief valve in place. Tighten until sealed and facing proper orientation for reconnection to the drain line.

**NOTE:** Use and type of joint sealer should be determined from local codes or the specifications of the installing contractor. Reconnect the drain line from the relief valve to the drain per local codes.

- 5) If any were disconnected, reconnect all electric and pneumatic lines, and restore power and instrument air to the system.
- 6) Reference the manufacturer's documentation for the T&P relief valve that was supplied with your unit for additional installation/setup instructions.
- 7) Follow the startup procedures to put the unit back online. Carefully check all connections for any sign of leakage.

**SECTION 4: MAINTENANCE****FIGURE 4-4: T&P Relief Valve Replacement Location****4.5 STRAINERS INSPECTION AND REPLACEMENT**

The strainers are installed upstream of the energy source shutoff valve. The strainers must be flushed periodically (approximately every three (3) to six (6) months) to prevent the buildup of any sediment.

**➤ STRAINERS INSPECTION AND REPLACEMENT INSTRUCTIONS**

- 1) Follow Steps 1 through 7 of the shutdown procedure in Section. 3.2 to take the unit offline before attempting this maintenance procedure.

**WARNING!**

**TURN OFF/DISCONNECT ALL ELECTRIC POWER BEFORE ATTEMPTING ANY MAINTENANCE PROCEDURE.**

- 2) The exact location of the strainers can differ between units, but refer to Figure 3-1a and 3-1b for a typical location. Reference the drawing supplied with the Submittal sheet for the unit to identify the exact location of the strainers on the unit.
- 3) Carefully break the line connections on the inlet side of both strainers.
- 4) Carefully break the line connection on the outlet side of the strainers.
- 5) Remove and examine the strainers.
- 6) Remove any sediment that is present in the strainers. If they cannot be cleaned satisfactorily, replace with new strainers.
- 7) Place the strainers back-in-line in the system.
- 8) Reconnect the inlet and outlet lines to each strainer. Follow recommendations contained in the manufacturer's documentation, local codes, or accepted contractor practices as to

## SECTION 4: MAINTENANCE

the use and/or type of joint compound or sealer at the connections.

- 9) Follow the startup procedures to put the unit back online. Carefully check all connections for any sign of leakage.

### 4.6 3-WAY CONTROL VALVE MAINTENANCE

The manufacturer documentation included with the unit gives specifics for operation and maintenance of the control valve. The Submittal sheet and drawing included with the unit will give the exact location, as well as interlocks with other components. This information should be reviewed before removal/replacement of the temperature control valve.

#### 4.6.1 3-Way Control Valve Maintenance

The valves and actuators require no maintenance or service. The valve stem is sealed with a maintenance-free O-ring gland. Open the electronics module of the 3-Way Controller Valve to view the two-color LED display, which indicates the operating status of the valve. See the table below to determine if the valve may possibly be faulty.

3-WAY CONTROL VALVE STATUS LEDs		
LED Display	Status	Description
Green LED	On continuously	Automatic mode: Auto (normal, no faults)
	Flashing	<ul style="list-style-type: none"> <li>– Mechanically set to MANUAL</li> <li>– Mechanically set to OFF</li> <li>– Currently in auto-calibration mode</li> </ul>
Red LED	On continuously	<ul style="list-style-type: none"> <li>– General fault</li> <li>– General calibration fault</li> <li>– Microcontroller fault</li> </ul>
	Flashing	– Faulty 24 VAC supply (or low power)
LED Off		<ul style="list-style-type: none"> <li>– No 24 VAC supply</li> <li>– Fault with electronics module</li> </ul>

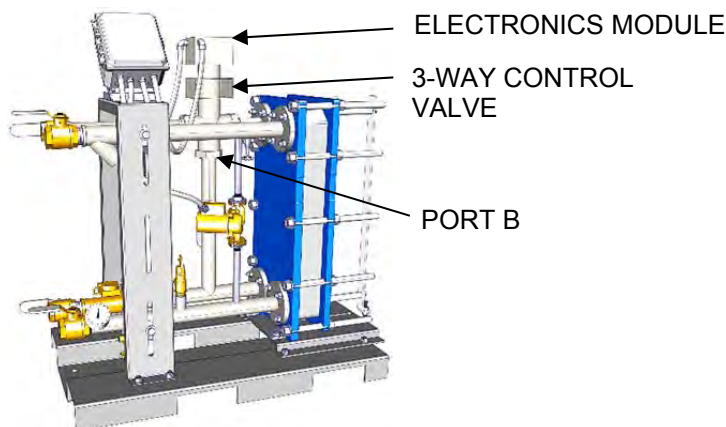
Should the valve electronics prove faulty, the electronics module should be replaced with a new one. Contact LAARS for part numbers and ordering information. See the replacement information below for mounting and installation.

#### 4.6.2 3-Way Control Valve Replacement

Mounting and operating instructions are printed on the actuator and on the electronics module.

The valve is suitable only for straight-through or three-way applications and may be installed only in a mixing arrangement. In the case of the straight-through valve, strict observance of the direction of flow is essential.

To replace a faulty or effective unit, refer to the following instructions.

**SECTION 4: MAINTENANCE****FIGURE 4-5: 3-Way Control Valve Component Locations****➤ 3-WAY CONTROL VALVE REPLACEMENT INSTRUCTIONS**

- 1) Follow Steps 1 through 7 of the shutdown procedure in Section 3.8 to take the unit offline before attempting this maintenance procedure.

**WARNING!**

Boiler water or high temperature water present situations that can be **very dangerous** because of the high temperatures and pressures. To avoid possible injury or death, use common sense and follow all accepted and recommended procedures when performing installation, operation, and maintenance procedures.

**WARNING!**

**TURN OFF/DISCONNECT ALL ELECTRIC POWER BEFORE ATTEMPTING ANY MAINTENANCE PROCEDURE.**

- 2) Assure that the energy source, water inlets, and outlets have been shut off; that the pressure has been bled from both the steam and energy source systems; that the unit has been completely drained; and that all components and surfaces have cooled.
- 3) Turn off the power and disconnect the leads to the valve.
- 4) Carefully break all connections to the control valve and remove the old valve from the unit.

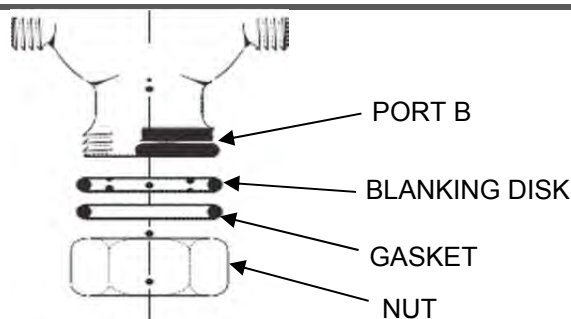
When installing the replacement valve, do not mount with actuator below horizontal position. It is essential to maintain the specified minimum clearance above and to the side of the actuator and/or electronics module for servicing, installing, and heat dissipation:

- 1/2-inch to 1-1/4 inches = 4 inches
- 1-1/2 inches to 2-1/2 inches = 6 inches

Port "B" can be sealed with the accessories supplied (blanking disk, gasket, and the nut).

**NOTE:** Blanking disks are not available for the large flange models.



**SECTION 4: MAINTENANCE****FIGURE 4-6: 3-Way Control Valve NPT Connection Components**

NOTE: NPT screwed valves are flat-faced to facilitate sealing with the gaskets supplied. Do not use hemp, tape, or thread-sealing compound. Do not insulate the actuator.

- 5) Reattach electrical connections. Follow local codes or accepted contractor practices as to the use and/or type of joint compound or sealer at the connections.
- 6) Follow the startup procedures to put the unit back online. Carefully check all connections for any sign of leakage.

## 4.7 TEMPERATURE CONTROLLER

The temperature controller is a digital solid-state device, which requires no periodic maintenance. Occasional physical checks of the unit should be carried out for physical and mechanical security of mounting, terminal blocks, and electrical wiring.

## 4.8 REPLACEABLE PARTS LIST

The following is a list of parts that are generally replaceable by personnel trained/certified on LAARS, Inc., water heaters. The replaceable parts may vary, depending on the unit and the particular design specifications in which the unit was constructed. If there are questions concerning the replaceable parts for the unit, refer to the original design specifications, or contact LAARS, Inc.

**Please have the unit's model and serial number available when contacting LAARS, Inc.**

NOTE:

Replaceable Parts may vary depending on design specification of the unit.

- 3-Way Control Valve
- Gaskets
- Heat Exchanger Plates
- T&P Relief Valve
- Recirculation Pump
- Thermocouples
- Strainers
- Isolation Valves



**SECTION 4: MAINTENANCE**

- Control Panel –Temperature Controller, etc.
- Support Frames/Brackets
- Hardware

**NOTE:**

Refer to Sections 4.12 and 4.13 for complete replacement part number information.

**4.9 RECOMMENDED SPARE PARTS:****TABLE 4-3: RECOMMENDED SPARE PARTS**

REFERENCE	ITEM NO.	QUANTITY PER UNIT	PART NAME
<b>SEC 4.12</b>	24	1	Recirculation pump
<b>SEC 4.12</b>	4	1	Control Valve Actuator Module
<b>SEC 4.13</b>	8 & 9	1	PID Controller
<b>SEC 4.12</b>	22	2	Thermocouples
<b>SEC 4.12</b>	25 & 29	1 each	Strainer screens
<b>SEC 4.12</b>	3	1	Heat exchanger
<b>SEC 4.12</b>	3	varies	Plates with gaskets
<b>SEC 4.12</b>	3	varies	Gaskets

**SECTION 4: MAINTENANCE**

## 4.10 INSPECTION SCHEDULE

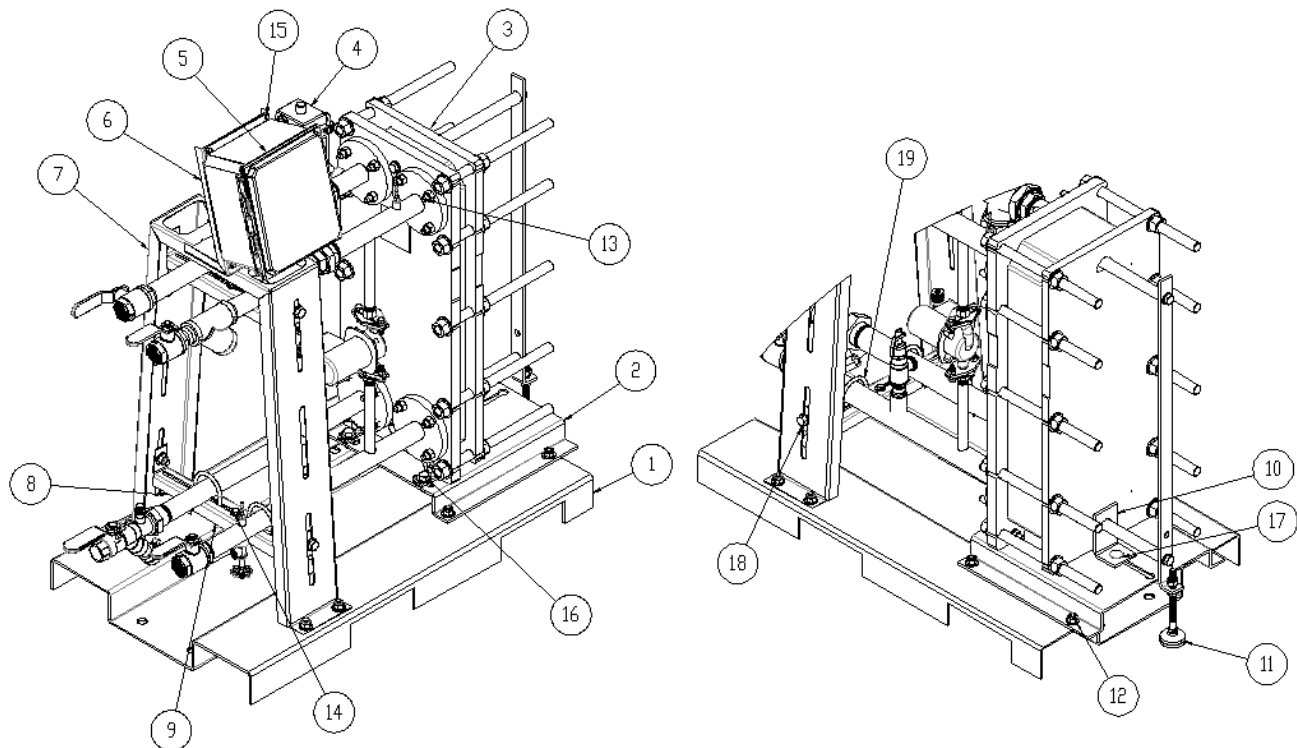
Table 4-4, below, summarizes the recommended time intervals for inspection of the water heater, components, inlet and outlet water and energy source lines (boiler water or high temperature water), and power connections.

<b>TABLE 4-4: RECOMMENDED INSPECTIONS TIME INTERVAL TABLE</b>						
<b>TO BE INSPECTED</b>	<b>PER MANUFACTURE SPECS.</b>	<b>WEEKLY</b>	<b>MONTHLY</b>	<b>3 MONTHS</b>	<b>6 MONTHS</b>	<b>1 YEAR</b>
Recirculation Pump	<b>X</b>					
Control Valve	<b>X</b>					
Temperature and Pressure Gauges				<b>X</b>		
Heat Exchanger Plates and Gaskets (measure performance)					<b>X</b>	
Inlet, Outlet and Return Connections				<b>X</b>		
Power and Ground Connections				<b>X</b>		
Relief Valves	<b>X</b>					
Isolation Valves		<b>X</b>				
Strainers				<b>X</b>		
Control Panel and Thermocouples					<b>X</b>	

**SECTION 4: MAINTENANCE**

**4.11 PARTS AND ACCESSORIES**

**COMMON PARTS**



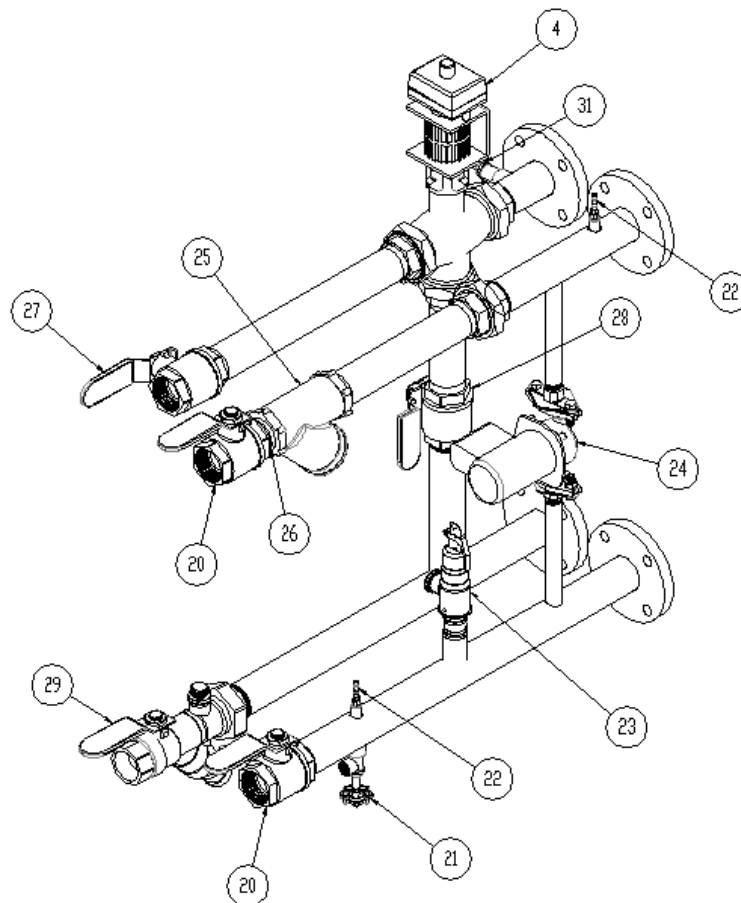
**TABLE 4-5: PLATE AND FRAME/BRAZED PLATE UNITS**

ITEM NO.	PART NO.	QUANTITY	PART DESCRIPTION
1	10024	1	BASE SKID – LAARS PLATE
2	10025	1	PLATFORM, HEAT EXCHANGER
3	SEE TABLE 4-8	1	D.W. HEAT EXCHANGER
4	MPART-A-MXV-0001	1	3-WAY CONTROL VALVE – 1-1/2" NPT
	MPART-A-MXV-0004		3-WAY CONTROL VALVE – 2" NPT
5	64001-1	1	CONTROL PANEL
6	40003	1	MOUNTING BRACKET, CONTROL PANEL
7	10027	1	A-FRAME
8	10028-1	2	PIPE SUPPORT, LEFT
9	10028-2	2	PIPE SUPPORT, RIGHT
10	10035	1	L BRACKET
11	MHRD-19-0002	1	LEVELING FOOT
	MHRD-01A-0003	2	HEX NUT 5/8"-11 - UNC 2B
12	MHRD-03-0015	8	SQUARE NECK CARRIAGE BOLT - 5/8"-11 X 1.25"LG FULL THREAD - UNC 2B
	MHRD-01B-0008	8	FLANGED LOCK NUT - 5/8"-11 - UNC 2B

**SECTION 4: MAINTENANCE**

13	MHRD-15-0050	16	STUD - 5/8"-11 X 3 "LG - UNC 2A
	MHRD-01A-0003	16	HEX NUT 5/8"-11 - UNC 2B
14	MHRD-03-0014	2	HEX BOLT - 3/8"-16 X 1.25"LG FULL THREAD - UNC 2B
	MHRD-05-0002	2	FLAT WASHER – 3/8" – TYPE A
	MHRD-01B-0007	2	FLANGED LOCK NUT - 3/8"-16 - UNC 2B
15	MHRD-03-0013	8	HEX BOLT - 1/4"-20 X 0.75"LG FULL THREAD - UNC 2A
	MHRD-05-0001	8	FLAT WASHER – 1/4" – TYPE A
	MHRD-01B-0006	8	FLANGED LOCK NUT - 1/4"-20 - UNC 2B
16	MHRD-03-0012	2	HEX BOLT - 5/8"-11 X 1.5"LG FULL THREAD - UNC 2A
	MHRD-05-0004	2	FLAT WASHER – 5/8" – TYPE A
	MHRD-01B-0008	2	FLANGED LOCK NUT - 5/8"-11 - UNC 2B
17	MHRD-03-0015	1	SQUARE NECK CARRIAGE BOLT - 5/8"-11 X 1.25"LG FULL THREAD - UNC 2B
	MHRD-01B-0008	1	FLANGED LOCK NUT - 5/8"-11 - UNC 2B
18	MHRD-03-0012	4	HEX BOLT – ZINC PLATED C.S. – 5/8"-11 X 1.5"LG FULL THREAD - UNC 2A
	MHRD-05-0008	4	FLAT WASHER (NARROW) – 5/8" – TYPE B
	MHRD-01B-0008	4	FLANGED LOCK NUT - 5/8"-11 - UNC 2B
19	MHRD-03-0016	4	U-BOLT - C.S.(ZINC) – 1-1/2" NPS X 3/8-16 - UNC 2A
	MHRD-03-0007		U-BOLT - C.S.(ZINC) - 2" NPS X 3/8-16 - UNC 2A
	MHRD-03-0017		U-BOLT - C.S.(ZINC) – 2.5" NPS X 3/8"-16 – UNC 2A
	MHRD-01B-0007	4	FLANGED LOCK NUT - 3/8"-16 - UNC 2B

**SECTION 4: MAINTENANCE**



**TABLE 4-6: DOMESTIC HOT WATER ASSEMBLY**

ITEM NO.	PART NO.	QUANTITY	PART DESCRIPTION
20	MPART-E-BV-0023	2	BALL VALVE – 1-1/2" FNPT – LEAD FREE
	MPART-E-BV-0024		BALL VALVE – 2" FNPT – LEAD FREE
	MPART-E-BV-0025		BALL VALVE – 2-1/2" FNPT – LEAD FREE
21	MPART-E-05-0003	1	3/4" NPT DRAIN VALVE - LEAD FREE
22	MELE-06-0250	2	THERMOCOUPLE
23	SEE TABLE 4-9	1	RELIEF VALVE
24	MELE-09-0015	1	RECIRCULATION PUMP
25	MPART-E-Y-0002	1	Y-STRAINER – 1-1/2" NPT – 250# - LEAD FREE
	MPART-E-Y-0003		Y-STRAINER – 2" NPT – 250# - LEAD FREE
	MPART-E-Y-0004		Y-STRAINER – 2-1/2" NPT – 250# - LEAD FREE
26	MFIT-3A3-S-18-0005-001	1	NIPPLE – 1-1/2" NPT X CLOSE X (SCH40/STD) – TWO END THREADED
	MFIT-3A3-S-18-0006-001		NIPPLE – 2" NPT X CLOSE X (SCH40/STD) – TWO END THREADED
	MFIT-3A3-S-18-0007-001		NIPPLE – 2-1/2" NPT X CLOSE X (SCH40/STD) – TWO END THREADED

**SECTION 4: MAINTENANCE**
**TABLE 4-7: BOILER HOT WATER ASSEMBLY**

ITEM NO.	PART NO.	QUANTITY	PART DESCRIPTION
27	MPART-E-BV-0023	1	BALL VALVE(FULL PORT) – 1-1/2" FNPT (-40F TO 400F) – 600 CWP – LEAD FREE
	MPART-E-BV-0024		BALL VALVE(FULL PORT) – 2" FNPT (-40F TO 400F) – 600 CWP – LEAD FREE
	MPART-2-X-0125	2	BUTTERFLY VALVE – 2-1/2" – 200 PSI
28	MPART-E-BV-0023	1	BALL VALVE(FULL PORT) – 1-1/2" FNPT (-40F TO 400F) – 600 CWP – LEAD FREE
	MPART-E-BV-0024		BALL VALVE(FULL PORT) – 2" FNPT (-40F TO 400F) – 600 CWP – LEAD FREE
	MPART-E-BV-0025		BALL VALVE(FULL PORT) – 2-1/2" FNPT (-40F TO 400F) – 400 CWP – LEAD FREE
29	MPART-E-04-0101	1	COMBINATION VALVE-STRAINER - 1-1/2" NPT
	MPART-E-04-0102		COMBINATION VALVE-STRAINER - 2" NPT
30	MPART-2-Y-0005-2.5	1	Y-STRAINER – 2-1/2"
	MPART-E-BV-0020		BALL VALVE – 3/4"
31	MPART-E-05-0003	1	3/4" NPT DRAIN VALVE - LEAD FREE
32	MHRD-15-0051	14	STUD – 5/8"-11 X 4" LG – UNC 2A
	MHRD-01A-0003	16	HEX NUT – 5/8"-11 – UNC 2B
	MHRD-15-0050	2	STUD – 5/8"-11 X 3" LG – UNC 2A

**TABLE 4-8: HEAT EXCHANGER**

ITEM NO.	PART NO.	QUANTITY	PART DESCRIPTION
3	<b>DOUBLE WALL PLATE AND FRAME</b>		
	MPART-3-20-0013	1	HEAT EXCHANGER (UNIT MODEL LP-18D)
	MPART-3-20-0014		HEAT EXCHANGER (UNIT MODEL LP-26D)
	MPART-3-20-0015		HEAT EXCHANGER (UNIT MODEL LP-36D)
	MPART-3-20-0028		HEAT EXCHANGER (UNIT MODEL LP-52D)
	MPART-3-20-0029		HEAT EXCHANGER (UNIT MODEL LP-80D)

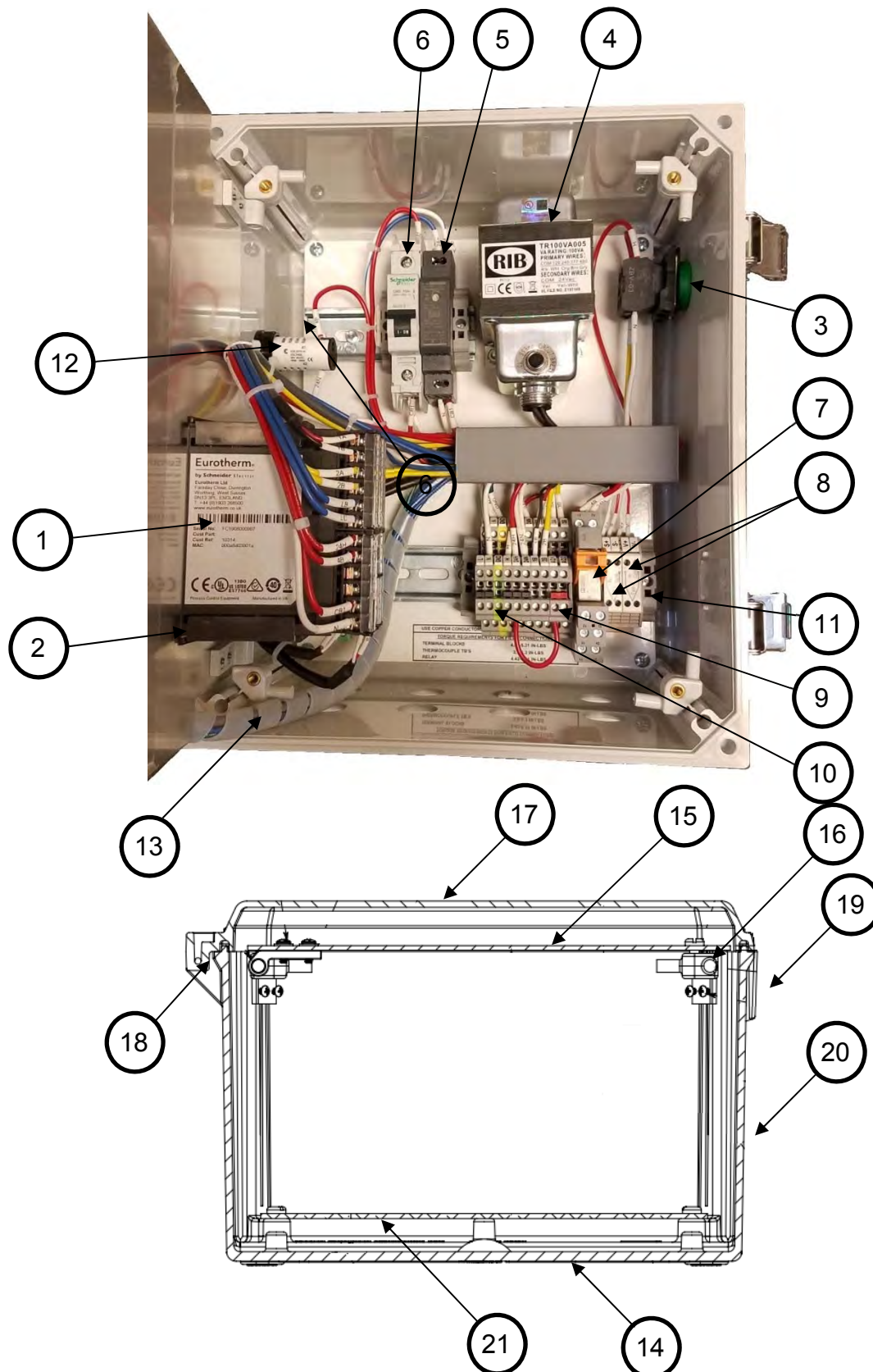
**TABLE 4-9: TEMPERATURE AND PRESSURE RELIEF VALVE**

ITEM NO.	PART NO.	QUANTITY	PART DESCRIPTION
23	MPART-E-RV1-0002	1*	3/4" NPT T&P RELIEF VALVE – LEAD FREE
	MPART-E-RV1-0005		1" NPT T&P RELIEF VALVE – LEAD FREE
	MPART-E-RV1-0004		1" NPT T&P RELIEF VALVE – LEAD FREE

\*Quantity may vary depending upon unit capacity requirement

SECTION 4: MAINTENANCE

4.12 CONTROL BOX PARTS



**SECTION 4: MAINTENANCE**

**TABLE 4-13: CONTROL PANEL PART NUMBERS**

ITEM	PART NO.	QTY.	DESCRIPTION
1	MELE-19-0008	1	TEMPERATURE CONTROLLER
2	MELE-19-0009	1	TEMPERATURE CONTROLLER MOUNTING CLIPS KIT
3	MELE-19-0010	1	POWER ON/OFF SELECTOR SWITCH
	MELE-19-0011	1	GREEN LED WITH N/O CONTACT
4	MELE-19-0012	1	TRANSFORMER
5	MELE-19-0013	1	24VDC POWER SUPPLY
6	MELE-19-0014	1	CIRCUIT BREAKER
7	MELE-19-0015	1	2 POLE RELAY SWITCH KIT
	MELE-19-0016	1	RELAY COIL ONLY
8	MELE-19-0017	2	THERMOCOUPLE TERMINAL BLOCKS
	MELE-19-0018	1	THERMOCOUPLE ENDPLATE
9	MELE-19-0019	9	DOUBLE HIGH TERMINAL BLOCKS
10	MELE-19-0006	1	ALARM SILENCE PUSHBUTTON
11	MELE-19-0007	1	SOUND ALARM/BUZZER
12	MELE-19-0020	1	DOUBLE HIGH GROUND TERMINAL BLOCK
13	MELE-19-0021	4	END ANCHORS
14	MELE-19-0022	1	CONTROL PANEL ENCLOSURE ASSEMBLY
15	MELE-19-0023	1	HINGED FRONT PANEL KIT
16	MELE-19-0024	1	HINGED PANEL HARDWARE REPLACEMENT KIT
17	MELE-19-0025	1	FRONT COVER
18	MELE-19-0026	1	STAINLESS STEEL HINGE PIN
19	MELE-19-0027	2	STAINLESS STEEL LATCH FOR ENCLOSURE
20	MELE-19-0028	1	ENCLOSURE BODY
21	MELE-19-0029	1	BACK PANEL



**SECTION 4: MAINTENANCE**

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**SECTION 5: TROUBLESHOOTING**

**SECTION 5: TROUBLESHOOTING**

The following table summarizes problems that may be encountered over the life of a LP Series unit, and the procedures to remedy those problems. The left-hand column lists the symptoms. The remaining columns are suggested procedures or “remedies” that should be followed to identify and correct the problem.

SYMPTOM	PROBABLE CAUSE(S)	REMEDY
Water heater is not able to maintain the required temperature at the rated capacity.	<ol style="list-style-type: none"> <li>1. The water heater temperature controls not set properly.</li> <li>2. Control valve is not opening and closing properly.</li> <li>3. Boiler water supply temperature is low.</li> <li>4. Boiler water flow rate is low.</li> <li>5. Boiler water inlet strainer is clogged.</li> <li>6. The heat exchanger is scaled on boiler water side.</li> <li>7. Water heater and control valve being used at higher than rated design capacity.</li> <li>8. Recirculating pump malfunctions/failed.</li> <li>9. Improper signal to control valve from control panel.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the set point settings on the controller. Readjust the set point settings if below the required temperature. Refer to programming sequence in section 3.11 for complete settings information.</li> <li>2. See the adjustment and testing instructions contained in the supplied Installation/Operations Manual. Repair or replace the valve if necessary. Refer to Sections 3.5 and 4.6 Control Valve Technical Information if hard copy is not available. Make sure valve is in Automatic mode.</li> <li>3. Check to make sure the boiler water inlet temperature gauge reading is equal to the design conditions. Readjust the boiler supply water temperature if necessary.</li> <li>4. Measure the boiler water supply flowrate using flowmeter and check the pump to make sure the flowrate is not lower than the design conditions.</li> <li>5. Check the differential pressure/dirt gauge and blowdown the strainer until the gauge is in GREEN region.</li> <li>6. Clean the heat exchanger per instructions in Section 4.3. Call LAARS or your authorized representative for instructions on repair or replacement if necessary. Also ensure the water quality levels are within the allowable limits.</li> <li>7. Check to make sure the operating conditions do not exceed the design conditions. Reduce the load or resize the heat exchanger.</li> <li>8. Recirculation piping temperature should be same as the hot water outlet temperature when recirculation pump is operating properly. Check the power supply or repair/replace the pump if needed.</li> <li>9. Open the valve cover and check 4-20mA control signal is present at valve terminals. Troubleshoot panel to restore proper signal to control valve if it malfunctions.</li> </ol>

**SECTION 5: TROUBLESHOOTING**

<p>DHW supply temperature is too high.</p>	<ol style="list-style-type: none"> <li>1. The water heater temperature control system/valve is not operating properly.</li> <li>2. The temperature controller or thermometer indicates wrong value.</li> <li>3. Control Valve is set in MANUAL mode.</li> <li>4. Control Valve requires calibration.</li> <li>5. Heat Exchanger is scaled on domestic water side.</li> </ol>	<ol style="list-style-type: none"> <li>1. See the adjustment and testing instructions contained in Section 3.5 for the specific temperature control system installed on the unit. Also, check to ensure that the thermocouple is installed and functioning correctly. Repair or replace thermocouple if needed. Replace the control valve and/or actuator if necessary. Refer to Section 4.6 for replacement instructions.</li> <li>2. Inspect and replace the temperature controller, thermocouple and/or thermometer if any of them not functioning properly.</li> <li>3. Make sure the Control Valve is set in AUTO mode.</li> <li>4. Recalibrate the control valve if needed per instructions in Section 3.5.</li> <li>5. Clean the heat exchanger per instructions in Section 4.3. Call LAARS or your authorized representative for instructions on repair or replacement if necessary. Also ensure the water quality levels are within the allowable limits.</li> </ol>
<p>DHW supply outlet temperature fluctuates significantly.</p>	<ol style="list-style-type: none"> <li>1. Control Valve does not open/close properly.</li> <li>2. Water heater and control valve being used at higher than rated design capacity.</li> <li>3. Recirculating pump malfunctions/failed.</li> <li>4. Ground wiring connection is loose or disconnected.</li> <li>5. The water heater temperature control system is not operating properly.</li> </ol>	<ol style="list-style-type: none"> <li>1. See the adjustment and testing instructions contained in the supplied manual for the specific temperature control valve installed on the unit. Replace the control valve and/or actuator if necessary. Refer to Section 4.6 for replacement instructions.</li> <li>2. Call LAARS or your authorized representative. Refer to the nameplate for the model and serial numbers of the unit and heat exchanger coil. Include these numbers in all correspondence.</li> <li>3. Recirculation piping temperature should be same as the hot water outlet temperature when recirculation pump is operating properly. Check the power supply or repair/replace the pump if needed. Also check building recirculation pump aquastat settings if being used.</li> <li>4. Check the ground connection to make sure it is not loose, which can cause electrical nuisance for temperature control (building stray voltage).</li> <li>5. Refer to the PID settings adjustment and testing instructions contained in Section 3.11 for the specific temperature control system installed on the unit. Also, check to ensure that the thermocouple is installed and functioning correctly. Repair or replace it if needed.</li> </ol>

**SECTION 5: TROUBLESHOOTING**

Excessive or insufficient boiler water being returned from the unit.	<ol style="list-style-type: none"> <li>1. The water return piping has not been installed properly to allow the water return; boiler water return line is restricted; or the return check valve is leaking or has failed.</li> <li>2. There is a water leakage in the heat exchanger.</li> </ol>	<ol style="list-style-type: none"> <li>1. Rearrange the boiler water return piping and inspect the valve for proper drainage. Also check to make sure there is no restriction in the water return line. Replace the check valve if it is leaking or has failed.</li> <li>2. Shut off the isolation valves on inlet and outlet of the unit and check to verify the presence of leakage. Disassemble, inspect, repair (if possible), or replace the heat exchanger and reassemble the unit.</li> </ol>
Unit is not heating the domestic water and control valve is closed.	<ol style="list-style-type: none"> <li>1. There is no power supply to control valve.</li> <li>2. There is no signal from controller to valve.</li> </ol>	<ol style="list-style-type: none"> <li>1. Open the valve cover and check to make sure 24VAC power is present at valve terminals. Troubleshoot panel to restore power if it is not present.</li> <li>2. Open the valve cover, and check 4-20mA control signal is present at valve terminals. Troubleshoot panel to restore proper signal to control valve if it malfunctions.</li> </ol>
Temperature and Pressure or pressure only relief valve "pops."	<ol style="list-style-type: none"> <li>1. Water 3-Way Control Valve does not close properly.</li> <li>2. Incoming water is preheated too much.</li> <li>3. Improperly sized or disconnected expansion tank in closed loop piping system.</li> <li>4. Inadequate water hammer arrestors.</li> <li>5. System/incoming water pressure is too high.</li> <li>6. Relief valve is faulty.</li> <li>7. Over temperature settings in PID controller not properly set or defective.</li> </ol>	<ol style="list-style-type: none"> <li>1. See the adjustment and testing instructions contained in Section 3.11 for the specific temperature control system installed on the unit. Also, check to ensure that the thermocouple is installed and functioning correctly. Repair or replace it if needed. Replace the control valve and/or actuator if necessary. Refer to Section 4.6 for replacement instructions.</li> <li>2. Maintain incoming cold water at least 10°F below the hot water supply temperature.</li> <li>3. Install the properly sized expansion tank in the closed loop piping system as shown in Installation and Piping drawings in Section 6.3.</li> <li>4. In order to avoid any shock waves, install water hammer arrestors/shock absorbers in the hot and cold water systems as needed.</li> <li>5. Bring the system water pressure below the relief valve setting.</li> <li>6. Inspect and adjust or replace the relief valve if it has failed. Contact LAARS representative for replacement.</li> <li>7. Check and readjust as necessary. Replace the defective parts as necessary. Refer to adjustment instructions contained in Section 3.11.</li> </ol>
Water heater	<ol style="list-style-type: none"> <li>1. Over temperature limit settings not</li> </ol>	<ol style="list-style-type: none"> <li>1. Refer to adjustment instructions contained in Section 3.11. Replace</li> </ol>

**SECTION 5: TROUBLESHOOTING**

shuts down at or too close to (above or below) the design outlet water temperature.	properly set or defective.	the defective parts as necessary.
A loud banging noise in the water heater or water piping (not to be confused with a normal clicking noise made during operation).	<ol style="list-style-type: none"> <li>1. Water return piping has not been installed properly to allow the water return circulation; the water return line is restricted; or the water return check valve is leaking or has failed.</li> <li>2. Improperly sized or disconnected expansion tank in closed loop piping system.</li> <li>3. Inadequate water hammer arrestors.</li> </ol>	<ol style="list-style-type: none"> <li>1. Rearrange the water return piping and inspect the valve for proper drainage. Also check to make sure there is no restriction in the water return line. Replace the check valve if it is leaking or has failed.</li> <li>2. Install the properly sized expansion tank in the closed loop piping system as shown in Installation and Piping drawings in Section 6.3.</li> <li>3. In order to avoid any shock waves, install water hammer arrestors/shock absorbers in the hot and cold water systems as needed. Also check for any trapped air in the domestic water system.</li> </ol>
Over-temperature sound alarm occurs frequently.	<ol style="list-style-type: none"> <li>1. Automatic over temperature settings not properly set or defective parts.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check and readjust the over-temperature setting as necessary. Refer to adjustment instructions contained in Section 3.11. Replace the defective parts or thermocouple if defective.</li> </ol>
Unable to clear Over-temperature sound alarm condition.	<ol style="list-style-type: none"> <li>1. Automatic over temperature settings not properly set or defective parts.</li> <li>2. Defective thermocouple.</li> <li>3. Recirculating pump malfunctions/failed. Flow is stagnant through the heat exchanger.</li> <li>4. Control valve requires calibration.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check and readjust the over-temperature setting as necessary. Refer to adjustment instructions contained in Section 3.11. Replace the defective parts.</li> <li>2. Replace the thermocouple if shorted.</li> <li>3. Check to make sure pump is functioning properly. Also, check for any blockage in the piping to ensure proper flow through heat exchanger.</li> <li>4. Recalibrate the Control valve per instructions in Section 3.5.2.</li> </ol>

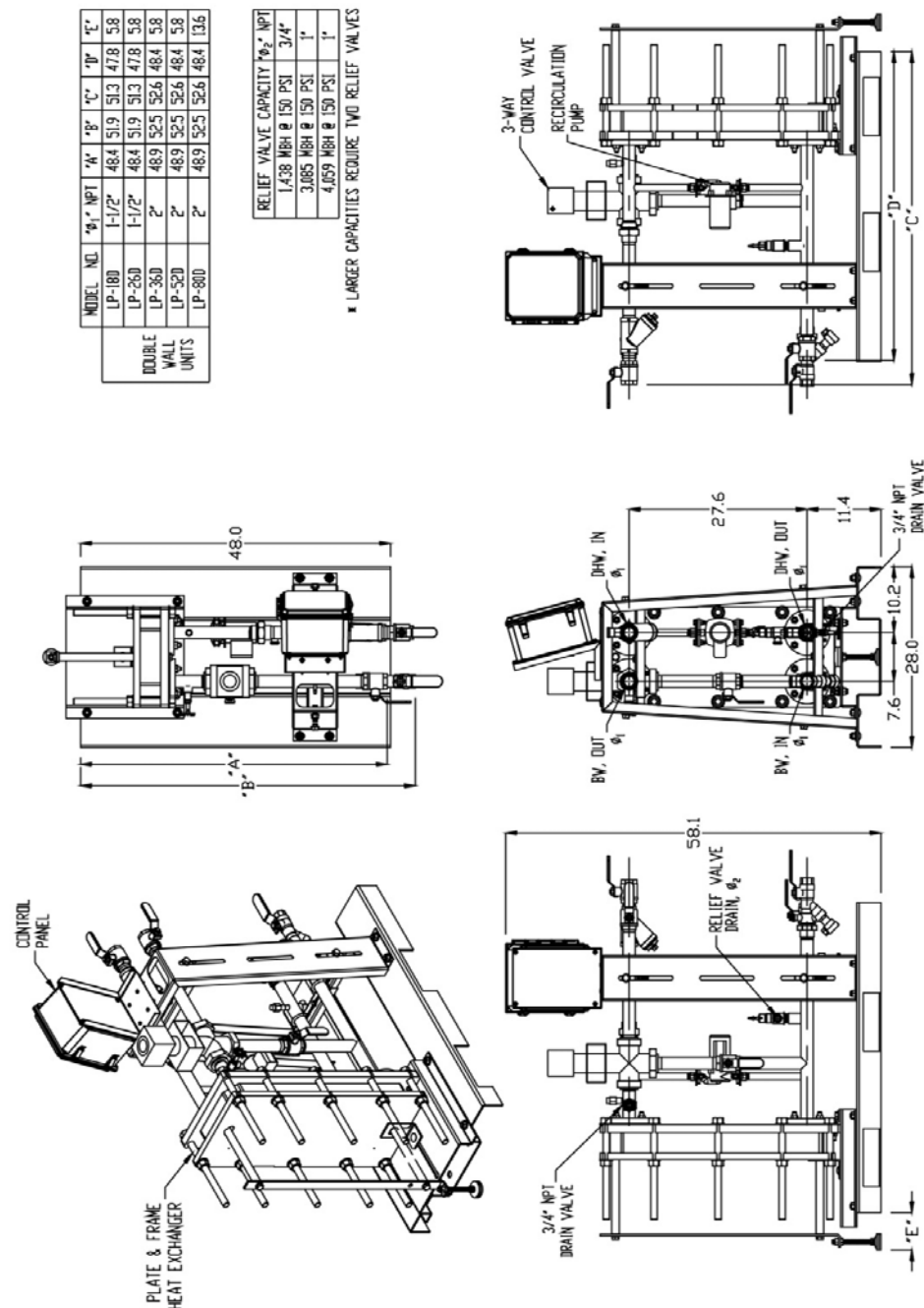
**SECTION 5: TROUBLESHOOTING**

Controller unit 'Locks Up.'	1. Controller 'Locks Up.'	<p>1. Recycle power to the unit by removing AC power, waiting 10 seconds and reconnecting power.</p> <div style="border: 2px solid black; padding: 10px; margin: 10px 0;"> <p><b>DANGER!</b></p> <p>This should be done by using the user provided circuit breaker or fuse, not by removing the power wires at the terminal block. Serious injury or death can occur if contact is made with the incoming AC power.</p> </div>
HMI and/or Controller display remains at zero or shows no change.	1. Display remains at zero or shows no change, but the process is changing.	1. Recycle power to the unit by removing AC power, waiting 10 seconds and reconnecting power. If the problem persists, contact the local LAARS representative.
Entire System is OFF.	2. External 120V AC power disconnected or ON/OFF switch on control panel failed/OFF.	2. Check to make sure external circuit breaker is ON and there is power supply available. Replace the ON/OFF switch on the control panel if faulty.

SECTION 6: TECHNICAL DRAWINGS AND FORMS

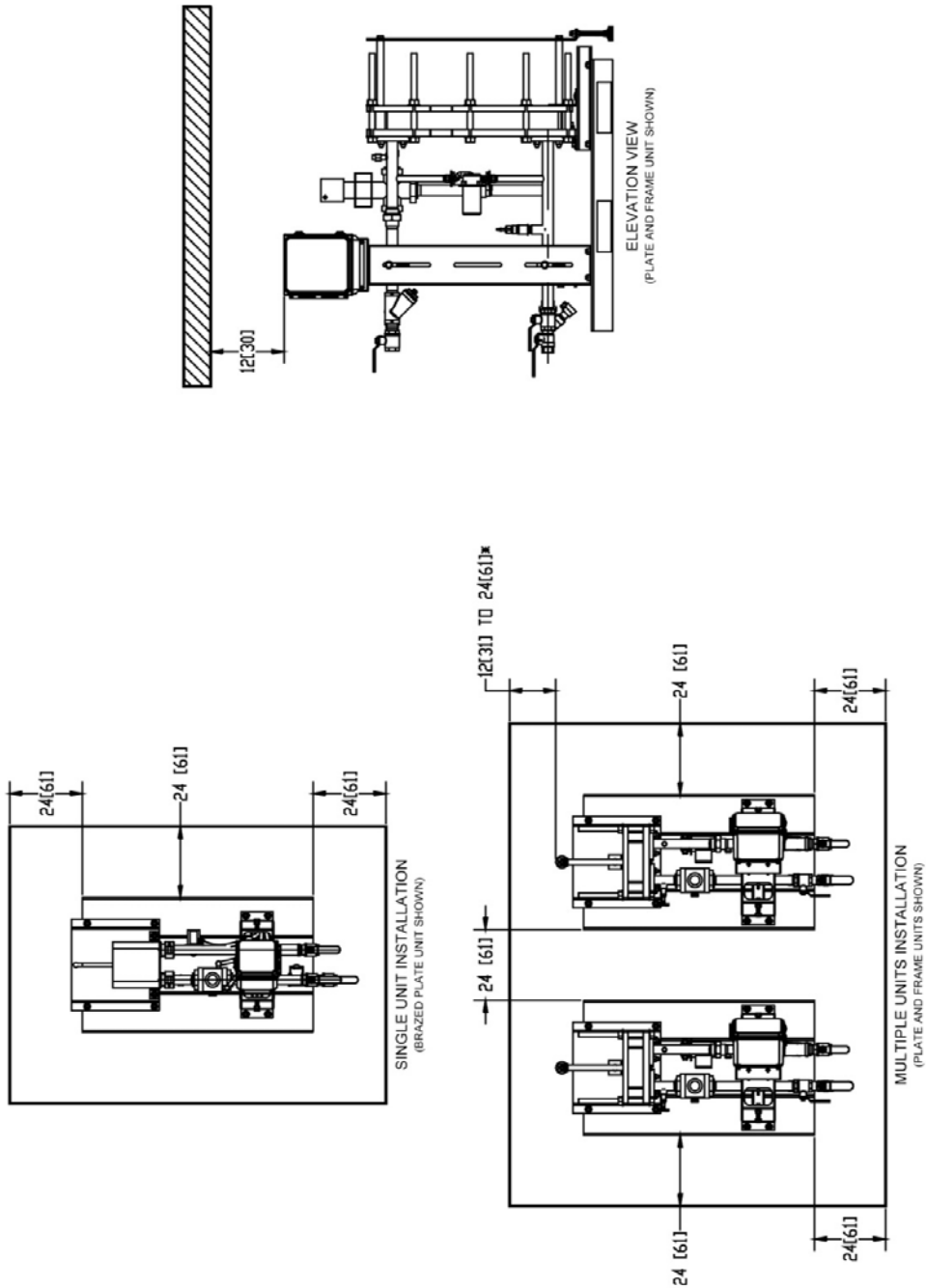
SECTION 6: TECHNICAL DRAWINGS & FORMS

6.1 DIMENSIONAL DRAWINGS



SECTION 6: TECHNICAL DRAWINGS AND FORMS

6.2 CLEARANCE DRAWINGS

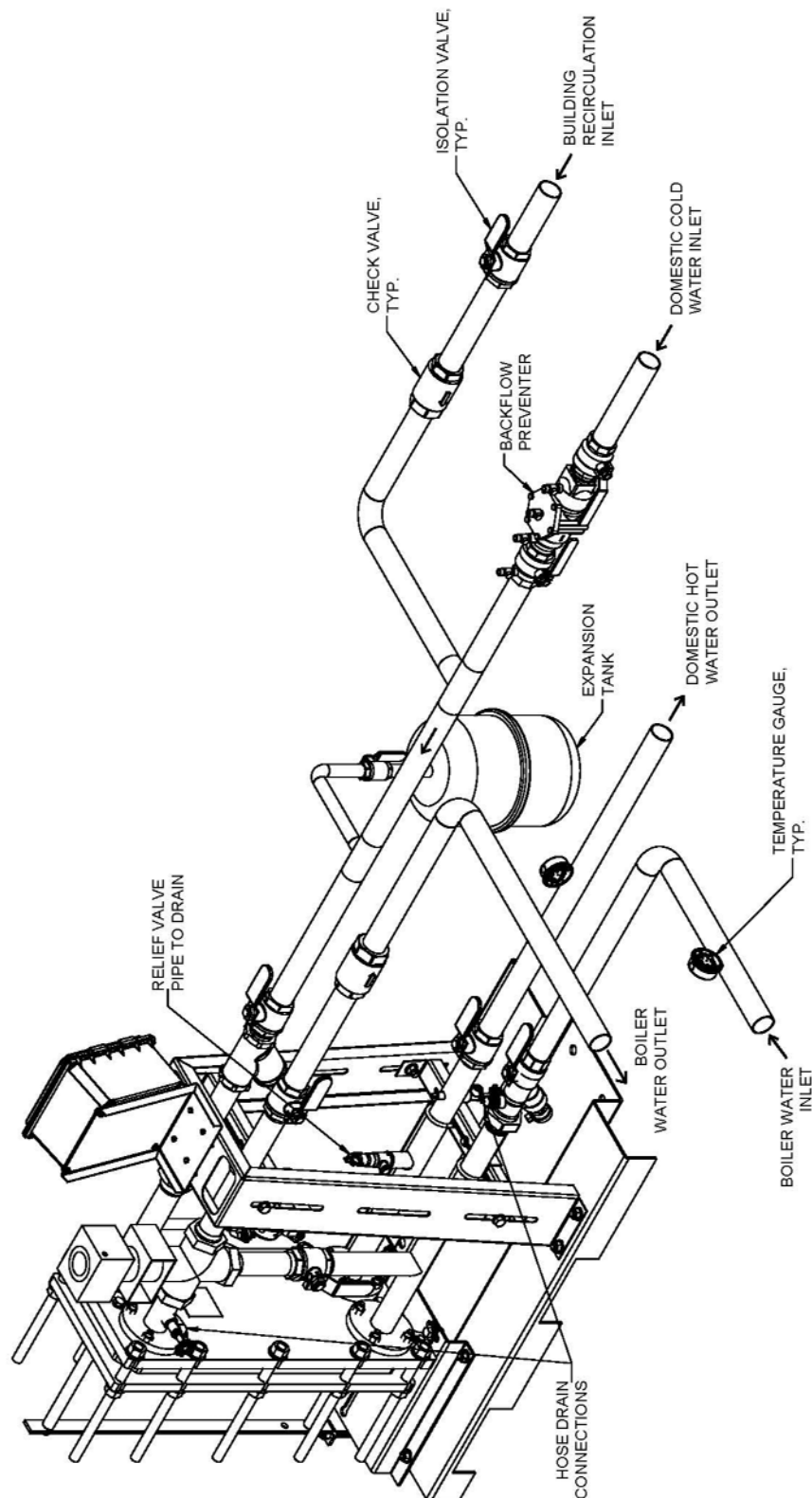


- NOTES:
1. ALL DIMENSIONS SHOWN ARE IN INCHES (CENTIMETERS).
  2. THIS DRAWING SHOWS MINIMUM RECOMMENDED SERVICE CLEARANCE DIMENSIONS AROUND THE UNIT. LOCAL CODES AND AUTHORITIES SHOULD ALSO BE CONSULTED.
  3. REFER TO WATER HEATER DIMENSIONAL DRAWING TO REVIEW OTHER DIMENSIONS.
  4. LAARS RESERVES THE RIGHT TO MODIFY THE DIMENSIONS WITHOUT PRIOR NOTICE.
  5. \* CLEARANCE DIMENSION VARIES DEPENDING UPON PLATE AND FRAME UNIT MODEL SELECTED.

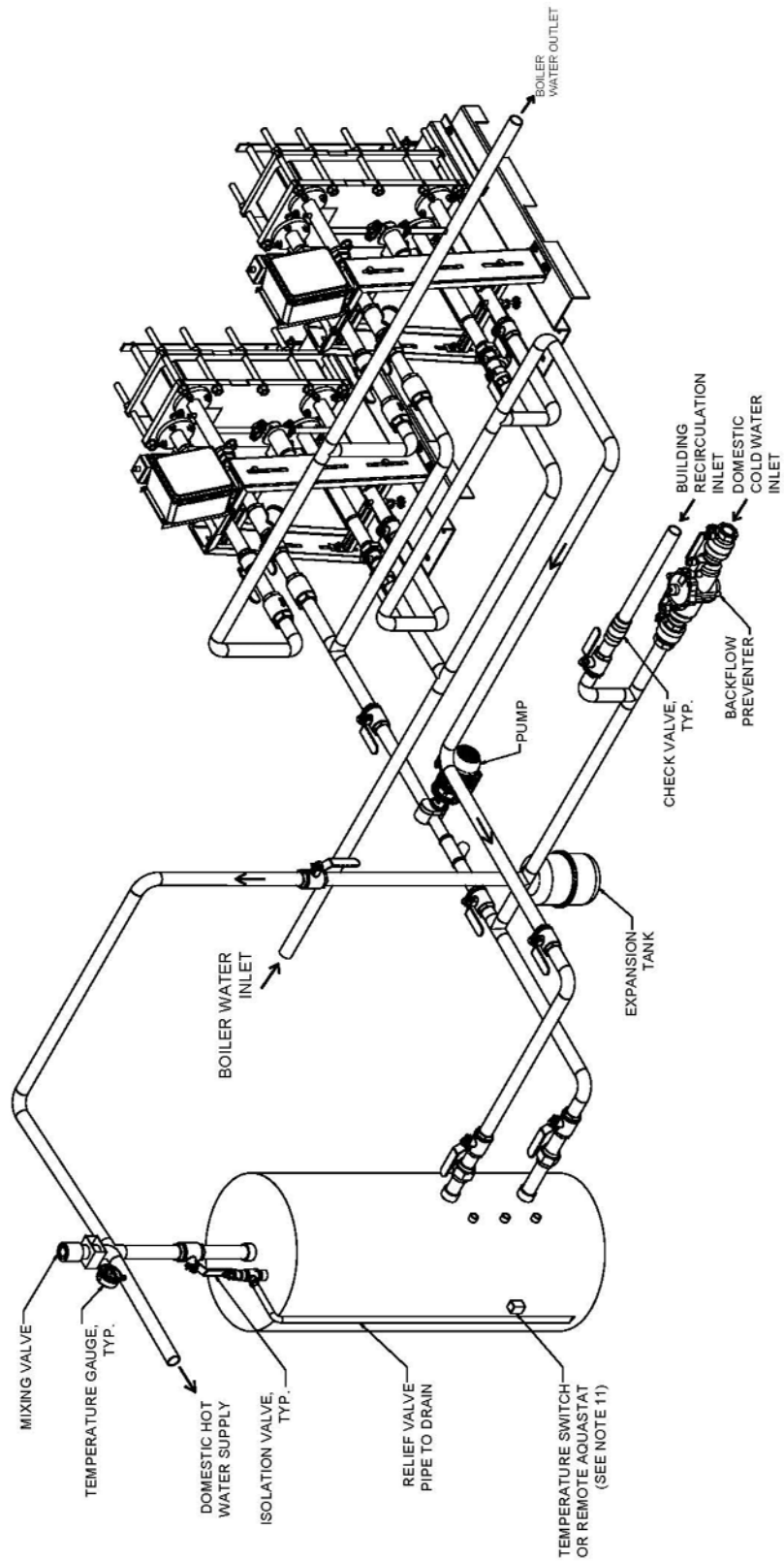


SECTION 6: TECHNICAL DRAWINGS AND FORMS

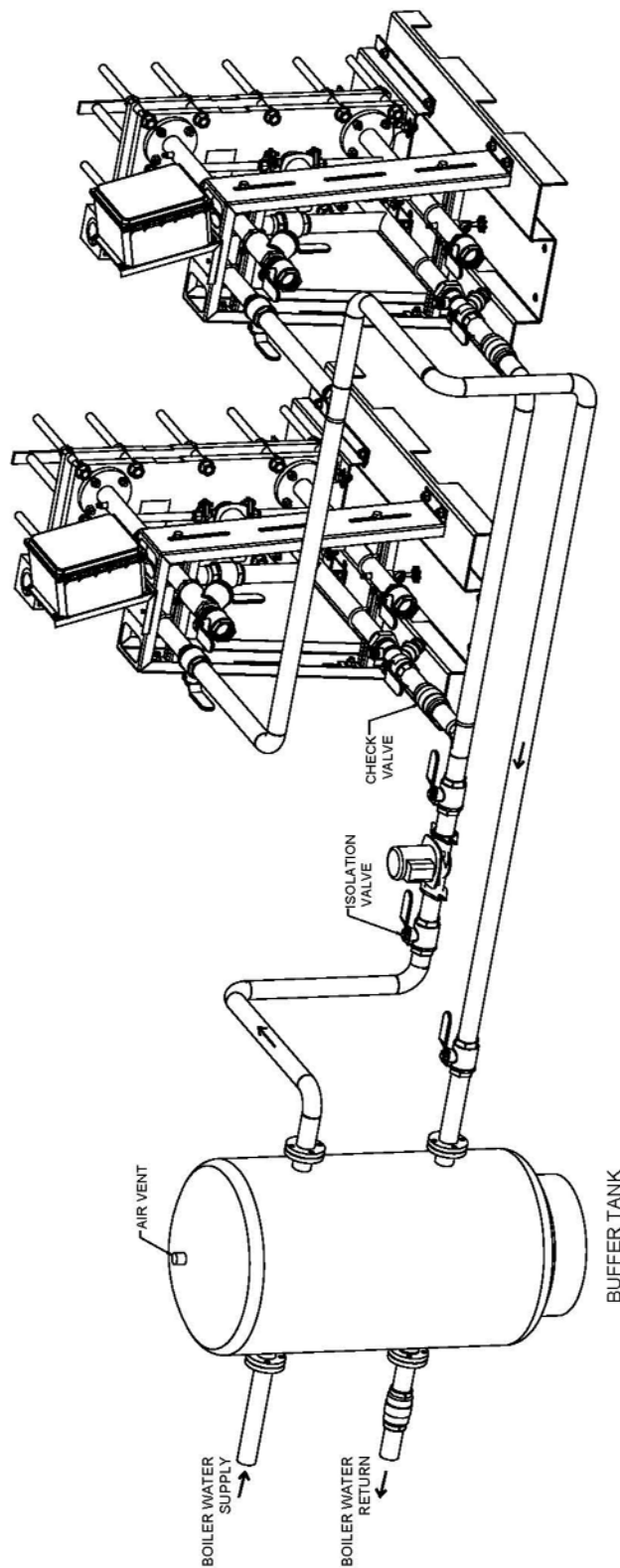
6.3 PIPING AND INSTALLATION DRAWINGS



SECTION 6: TECHNICAL DRAWINGS AND FORMS



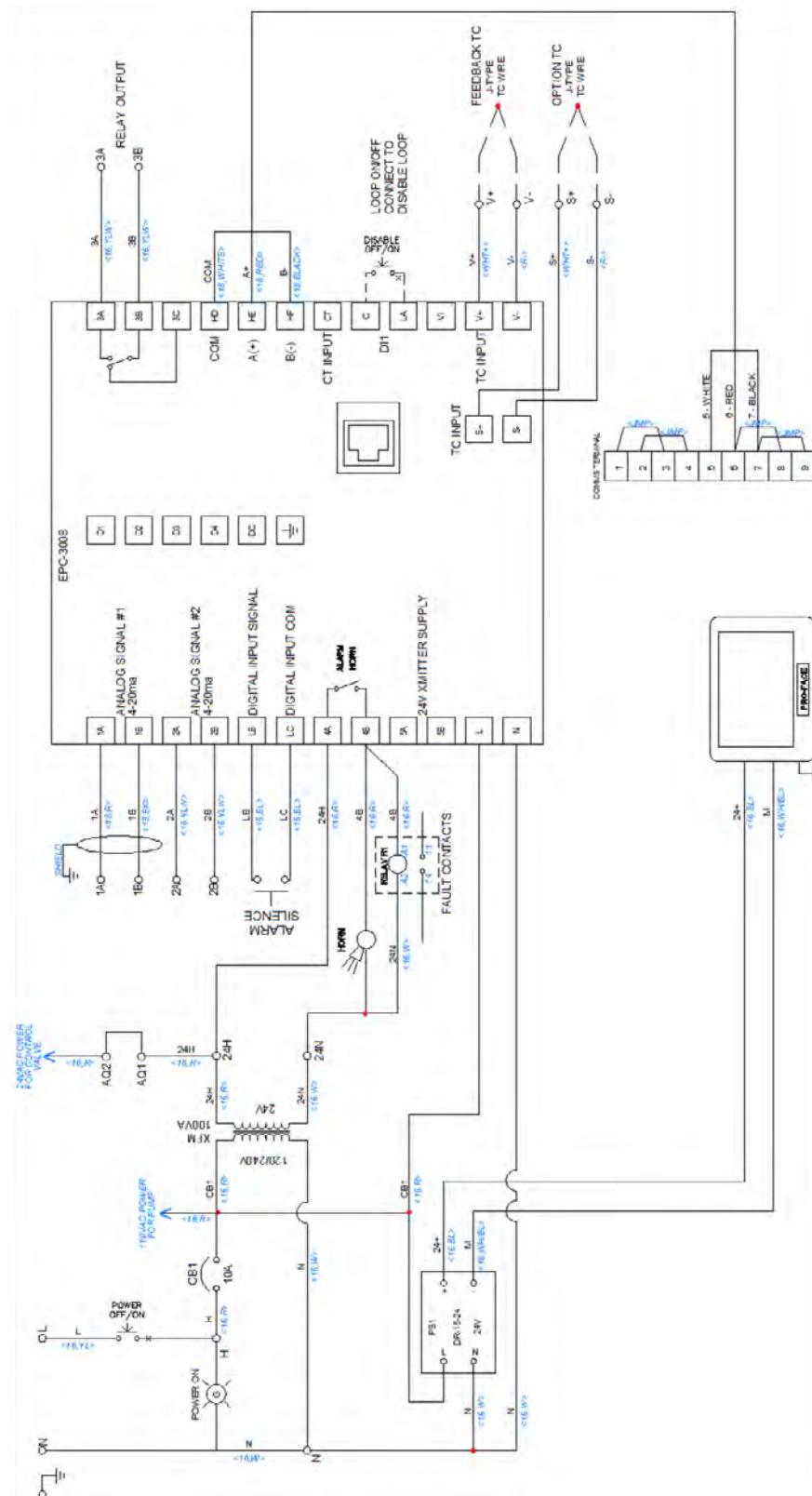
SECTION 6: TECHNICAL DRAWINGS AND FORMS



SECTION 6: TECHNICAL DRAWINGS AND FORMS

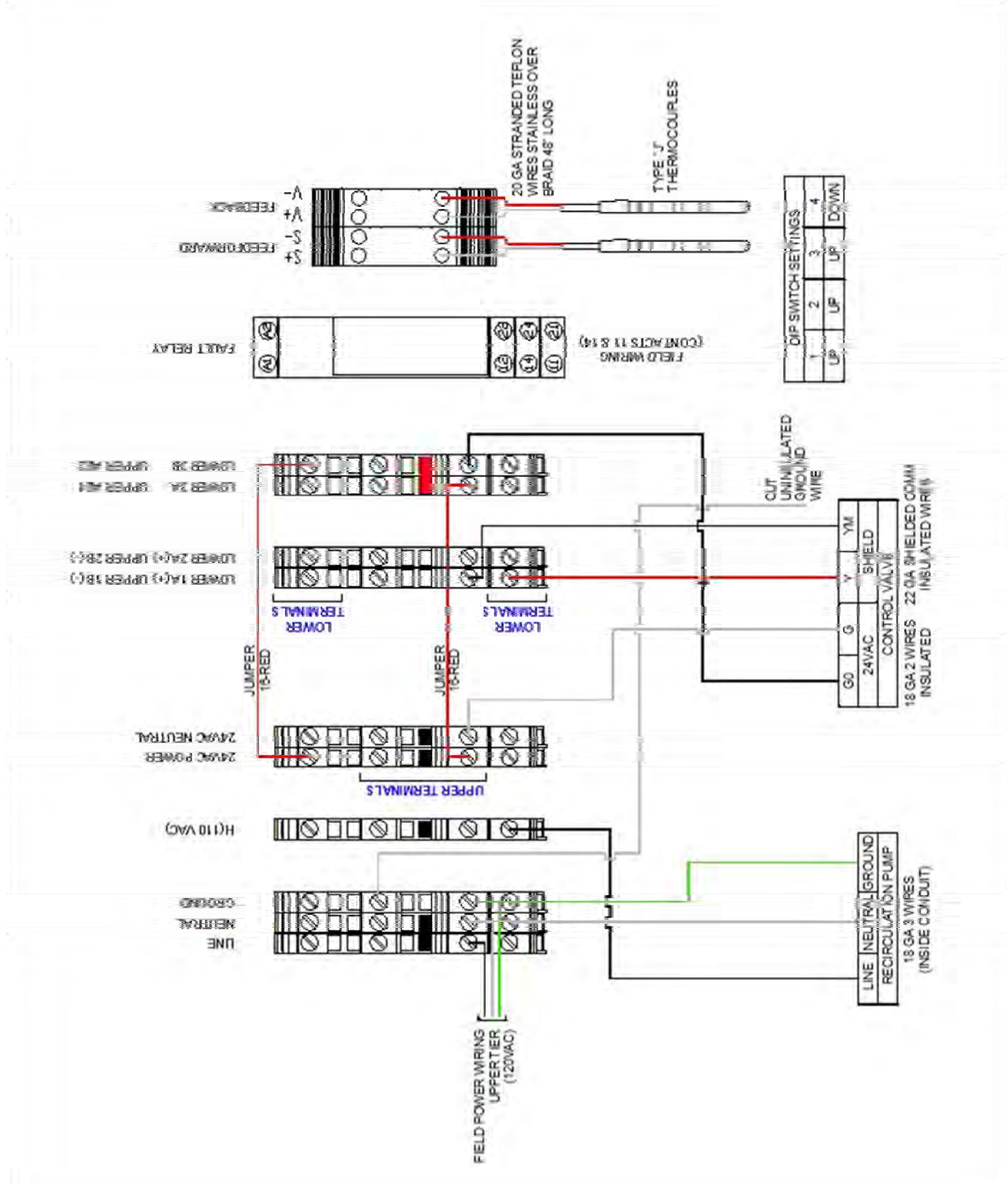
# 6.4 ELECTRICAL WIRING DIAGRAMS/SCHEMATICS

## Control Box Internal Electrical Wiring Diagram:



**SECTION 6: TECHNICAL DRAWINGS AND FORMS**

**Terminal Block Wiring Connections:**



SECTION 6: TECHNICAL DRAWINGS AND FORMS

## 6.5 FORMS AND RECORDS

### 6.5.1 Water Heater Controller Programming Record Sheet

#### LAARS Water Heater Controller Programming Record Sheet

MODEL NUMBER: \_\_\_\_\_

SERIAL NUMBER: \_\_\_\_\_

VERSION: \_\_\_\_\_

PASSWORD: \_\_\_\_\_

#### SETPOINTS

#### SETPOINT

PRIMARY ALARM ON AT \_\_\_\_\_

PASSWORD: \_\_\_\_\_

PRIMARY ALARM OFF AT \_\_\_\_\_

INPUT FILTER \_\_\_\_\_

SECONDARY ALARM ON AT \_\_\_\_\_

UNIT TEXT \_\_\_\_\_

SECONDARY ALARM OFF AT \_\_\_\_\_

#### SCALING

DECIMAL POINT \_\_\_\_\_

ANALOG INPUT LOW \_\_\_\_\_

ANALOG INPUT HIGH \_\_\_\_\_



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